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Vol. II

TRANSCRIPT OF RECORD

Supreme Court of the United States

OCTOBER TERM, 1938

No. 466

HONOLULU OIL CORPORATION, LTD., AND M. O. JOHNSTON OIL FIELD SERVICE CORPORATION, PETITIONERS,

vs.

ERLE P. HALLIBURTON AND HALLIBURTON OIL WELL CEMENTING COMPANY

No. 479

ERLE P. HALLIBURTON AND HALLIBURTON OIL WELL CEMENTING COMPANY, PETITIONERS,

vs.

HONOLULU OIL CORPORATION, LTD., AND M. O. JOHNSTON OIL FIELD SERVICE CORPORATION

ON WRITS OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE NINTH CIRCUIT

PETITION FOR CERTIORARI FILED NOVEMBER 8, 1938.
PETITION FOR CERTIORARI FILED NOVEMBER 18, 1938.

CERTIORARI GRANTED DECEMBER 19, 1938.

Supreme Court of the United States

October Term, 1938

No.............

HONOLULU OIL CORPORATION, LTD., a Corporation, and M. O. JOHNSON OIL FIELD SERVICE CORPORATION, a Corporation,

Petitioners,

vs.

ERLE P. HALLIBURTON and HALLIBURTON OIL WELL CEMENTING COMPANY, a Corporation,

Respondents.

Book of Exhibits
Accompanying
Transcript of Record

No.

In the United States
Circuit Court of Appeals
For the Ninth Circuit.

ERLE P. HALLIBURTON and HALLIBURTON OIL WELL CEMENTING COMPANY, a corporation,

Appellants,

vs.

HONOLULU OIL CORPORATION, LTD., a corporation, and M. O. JOHNSTON OIL FIELD SERVICE CORPORATION, a corporation,

Appellees.

VOLUME 2
Book of Exhibits
Accompanying
Transcript of Record

Upon Appeal from the District Court of the United States for the Southern District of California, Northern Division.

Parker & Baird Company, Law Printers, Los Angeles.

INDEX TO BOOK OF EXHIBITS.

PLAINTIFFS' EXHIBITS. PAGE

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE

To all persons to whom these presents shall come, Greeting:

THIS IS TO CERTIFY that the annexed is a true copy from the records of this office of the

Letters Patent of
John T. Simmons,
assignor, by direct and meane assignments, to
Erle P. Halliburton,

2

Number 1,930,987, Granted October 17, 1933,

for

Improvement in Methods and Apparatus for Testing the Productivity of Formations Encountered in Wells.

No. D-56-Eq
Halliburton et al
vs.
Honolulu Oil Corp.
Plfs EXHIBIT
No. 1
Filed 11/11 1935
R. S. ZIMMERMAN, Clerk
By Cross
Deputy Clerk

IN TESTIMONY WHEREOF I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this twenty-sixth day of October, in the year of our Lord one thousand nine hundred and thirty-five and of the Independence of the United States of America the one hundred and sixtieth

ATTEST:

Chief of Division

1930987

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Whereas JOHN T. SIMMONS, of El Dorado, Arkansas, assignor, by direct and mesne assignments, to ERLE P. HALLIBURTON, of Los Angeles, California,

PRESENTED TO THE **Commissioner of Patents** A PETITION PRAYING FOR THE GRANT OF LETTERS PATENT FOR AN ALLEGED NEW AND USEFUL IMPROVEMENT IN

METHODS AND APPARATUS FOR TESTING THE PRODUCTIVITY OF FORMATIONS ENCOUNTERED IN WELLS,

A DESCRIPTION OF WHICH INVENTION IS CONTAINED IN THE SPECIFICATION OF WHICH A COPY IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND COMPLIED WITH THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED, AND

Whereas UPON DUE EXAMINATION MADE THE SAID CLAIMANT is ADJUDGED TO BE JUSTLY ENTITLED TO A PATENT UNDER THE LAW.

NOW THEREFORE THESE **Letters Patent** ARE TO GRANT UNTO THE SAID

Erle P. Halliburton, his heirs OR ASSIGNS

FOR THE TERM OF SEVENTEEN YEARS FROM THE DATE OF THIS GRANT

THE EXCLUSIVE RIGHT TO MAKE, USE AND VEND THE SAID INVENTION THROUGHOUT THE UNITED STATES AND THE TERRITORIES THEREOF.

In testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed at the City of Washington this seventeenth day of October in the year of our Lord one thousand nine hundred and thirty-three, and of the Independence of the United States of America the one hundred and fifty-eighth.

(SEAL)

Attest:

G. P. Tucker

Law Examiner.

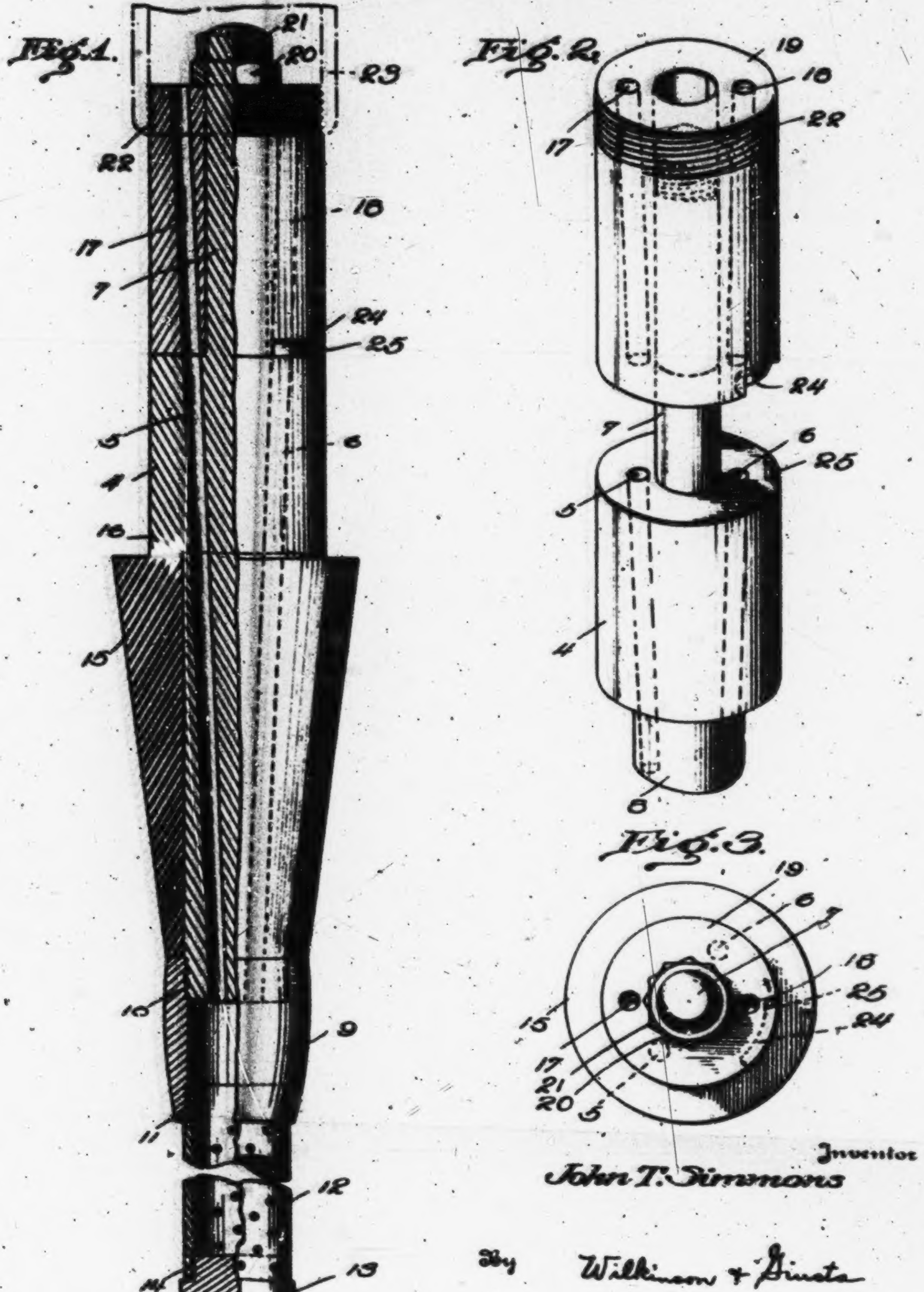
Conway P. Coe

Commissioner of Patents

Oct. 17, 1933. J. T. SIMMONS 1,930,987

METHOD AND APPARATUS FOR TESTING THE PRODUCTIVITY OF FORMATIONS ENCOUNTERED IN WELLS

Filed Feb. 10, 1926



Inventor

John T. Simmons

By Wilkinson & Giusta

Attorneys

Fig. 1.

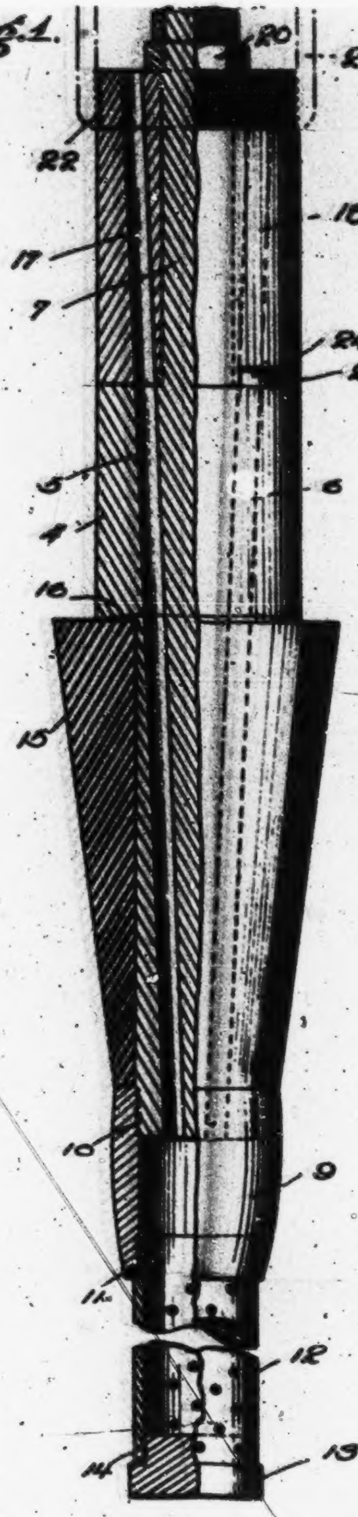


Fig. 2.

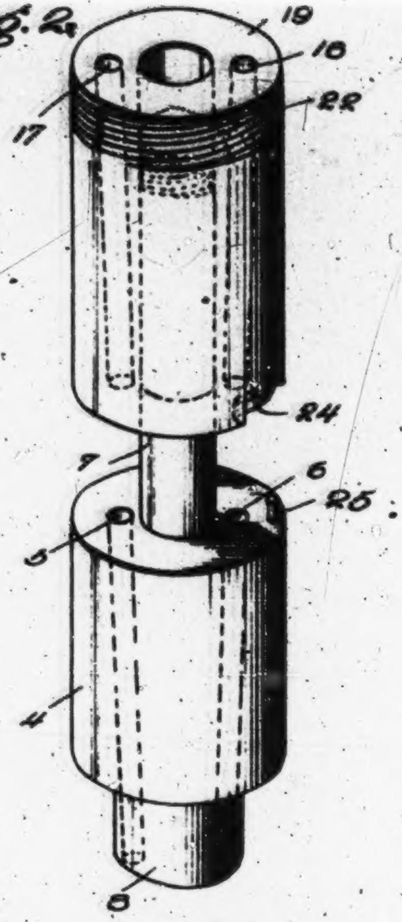
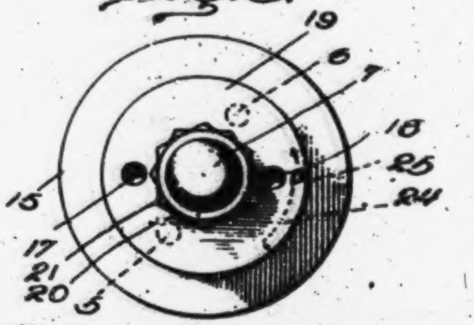


Fig. 3.



Inventor

John T. Simmons

By Wilkinson & Giusta

Attorneys

Patented Oct. 17, 1933 1,930,987

UNITED STATES PATENT OFFICE

1,930,987

METHOD AND APPARATUS FOR TESTING THE PRODUCTIVITY OF FORMATIONS ENCOUNTERED IN WELLS

John T. Simmons, El Dorado, Ark., assignor, by direct and mesne assignments, to Erle P. Halliburton, Los Angeles, Calif.

Application February 10, 1926. Serial No. 87,323

19 Claims. (Cl. 166—1)

The present invention relates to methods and apparatus for testing the productivity of formations encountered in drilling oil and other deep wells, and refers particularly to methods and apparatus employed when such wells are drilled by the rotary method.

In the rotary method of drilling wells, the well is kept filled with a mud-laden fluid. This mud-laden fluid is employed for the purpose of carrying away the detritus formed by the cutting bit and for maintaining a hydraulic pressure upon the sides of the hole, which prevents the hole from caving. In most wells drilled by the rotary process, it is impossible, without danger to the hole, to remove the mud-laden fluid without providing some other support to conserve the hole bore. The hydraulic pressure of the mud-laden fluid in the well is very great, being often in excess of two thousand pounds per square inch. In most instances, this pressure is in excess of the head upon the cognate fluids, either oil, water or gas, encountered in the formations penetrated by the drill. Under these circumstances, while drilling there may be no indication whatever at the surface of the well of the productivity or even existence of such cognate fluids. It is therefore necessary to perform a special testing operation whenever it is desired to determine whether such a formation contains a fluid which upon removal of the pressure of the mud-laden fluid will enter the well bore.

Under the present practice, when making such a test, it is necessary to remove the mud-laden fluid from the well bore until the hydraulic head of liquid within the well is sufficiently below the head of the cognate fluids in the formation in order to allow this latter fluid to enter the well bore. In order that this mud-laden fluid may be removed from the well bore without danger of the well caving in, it is the general practice to set a string or strings of casing in the well so that this string or strings of casing may support the wall of the well when the mud-laden casing is then known as a water string. In testing a well, the hole below the bottom of this water string is then protected by another string set inside the water string.

In case the test develops that the formation tested is barren or not commercially productive or contains water and it is therefore desired to deepen the hole, it is necessary to refill the hole with mud-laden fluid, to remove if possible the inner perforated string, and to resume drilling. The cemented water string, however, must be left in the hole, which not only entails the cost of this string but decreases the size of the hole which can be thereafter drilled. If the testing operation is repeated with the setting of successive water strings, the size of the hole may ultimately become too small for successful drilling operations and attempts to drill deeper must therefore be abandoned.

An object of the present invention is to provide a method and apparatus for testing formations which is cheaper, quicker and more effective than the methods now in use. More particularly an object of the present invention is to provide a method and apparatus for testing the formations penetrated by a drill, which method and apparatus may be employed without the necessity of removing the mud-laden fluid from the well bore.

Another object of my invention is to provide a method and apparatus for testing formations being penetrated by a drill, which method and apparatus does not require the setting of a water string above the formation to be tested and thus permits the testing of a well without involving the cost of such water string.

Another object of my invention is to provide a method and apparatus for testing formations being pentrated by a drill, which method and apparatus does not entail decreasing the size of the well bore.

Another object of my invention is to provide a method and apparatus for obtaining a sample of the cognate fluid in the formation to be tested

METHOD AND APPARATUS FOR TESTING THE PRODUCTIVITY OF FORMATIONS ENCOUNTERED IN WELLS

John T. Simmons, El Dorado, Ark., assignor, by direct and mesne assignments, to Eric P. Halliburton, Los Angeles, Calif.

Application February 10, 1936. Serial No. 67,223

19 Claims. (Cl. 166—1)

The present invention relates to methods and apparatus for testing the productivity of formations encountered in drilling oil and other deep wells, and refers particularly to methods and apparatus employed when such wells are drilled by the rotary method.

In the rotary method of drilling wells, the well is kept filled with a mud-laden fluid. This mud-laden fluid is employed for the purpose of carrying away the detritus formed by the cutting bit and for maintaining a hydraulic pressure upon the sides of the hole, which prevents the hole from caving. In most wells drilled by the rotary process, it is impossible, without danger to the hole, to remove the mud-laden fluid without providing some other support to conserve the hole bore. The hydraulic pressure of the mud-laden fluid in the well is very great, being often in excess of two thousand pounds per square inch. In most instances, this pressure is in excess of the head upon the cognate fluids, either oil, water or gas, encountered in the formations penetrated by the drill. Under these circumstances, while drilling there may be no indication whatever at the surface of the well of the productivity or even existence of such cognate fluids. It is therefore necessary to perform a special testing operation whenever it is desired to determine whether such a formation contains a fluid which upon removal of the pressure of the mud-laden fluid will enter the well bore.

Under the present practice, when making such a test, it is necessary to remove the mud-laden fluid from the well bore until the hydraulic head of liquid within the well is sufficiently below the head of the cognate fluids in the formation in order to allow this latter fluid to enter the well bore. In order that this mud-laden fluid may be removed from the well bore without danger of the well caving in, it is the general practice to set a string or strings of casing in the well so that this string or strings of casing may support the wall of the well when the mud-laden fluid is withdrawn. The lower portion of at least the inside string of casing is perforated in order that the fluids from the formation may enter the casing after the removal of the mud-laden fluid. If a water sand has been encountered above the formation to be tested, it is necessary to run in a string of casing and cement or otherwise seal its bottom to the sides of the well bore at a point below the known water level, in order to protect the formation being tested from this upper water strata. This string of casing is then known as a water string. In testing a well, the hole below the bottom of this water string is then protected by another string set inside the water string.

In case the test develops that the formation tested is barren or not commercially productive or contains water and it is therefore desired to deepen the hole, it is necessary to refill the hole with mud-laden fluid, to remove if possible the inner perforated string, and to resume drilling. The cemented water string, however, must be left in the hole, which not only entails the cost of this string but decreases the size of the hole which can be thereafter drilled. If the testing operation is repeated with the setting of successive water strings, the size of the hole may ultimately become too small for successful drilling operations and attempts to drill deeper must therefore be abandoned.

An object of the present invention is to provide a method and apparatus for testing formations which is cheaper, quicker and more effective than the methods now in use. More particularly an object of the present invention is to provide a method and apparatus for testing the formations penetrated by a drill, which method and apparatus may be employed without the necessity of removing the mud-laden fluid from the well bore.

Another object of my invention is to provide a method and apparatus for testing formations being penetrated by a drill, which method and apparatus does not require the setting of a water string above the formation to be tested and thus permits the testing of a well without involving the cost of such water string.

Another object of my invention is to provide a method and apparatus for testing formations being pentrated by a drill, which method and apparatus does not entail decreasing the size of the well bore.

Another object of my invention is to provide a method and apparatus for obtaining a sample of the cognate fluid in the formation to be tested without substantial contamination of such sample.

In accordance with my invention, whenever it is desired to test the productivity of a formation in a well, I establish an empty chamber or conduit in the well bore adjacent the formation to be tested without removing the mud-laden fluid from the well, and then permit the cognate fluids of the formation to discharge into said empty chamber or conduit. In the preferred form of the invention, such empty chamber is established

extending from the formation tested to the top of the well, whereby, in certain cases when the cognate fluids of the formation are under sufficient pressure, the well may commence producing through this conduit. In other cases where cognate fluids of the formation are not under such high pressure, the conduit may be again shut off from communication with the formation after certain amount of the cognate fluids of the formation have entered the empty conduit or chamber. This closing of the conduit is effected by an operator at the top of the well who can open and close the conduit at will. Following the entrance of the cognate fluid into the empty conduit or chamber, the apparatus may be elevated to the top of the well with the entrapped fluid content. The conduit being closed, the mud-laden fluid in the well is prevented from entering the conduit and contaminating the sample or otherwise interfering with the testing process.

The present invention also preferably embodies a means by which the formation to be tested may be sealed off from the hydraulic pressure of the mud-laden fluid standing within the well during the testing operation, and also includes a method and means by which the hydraulic pressure of the mud-laden fluid in the well may be reimposed upon the formation after the completion of the testing operation without either of these steps requiring any removal of mud-laden fluid from the well bore.

The present invention also provides a method and apparatus by which a formation may be tested through the penetration of the lower end of the testing apparatus into a so-called "rat hole", or an extension of the well bore of reduced diameter, the bottom of the hole thus leaving the hole provided with a seat above the formation to be tested which may be employed for setting of water or other string of casing if the test on the well establishes the productivity of a formation.

Various further objects and advantages of the present invention will appear from a description of a preferred form or example of the present invention. For this purpose, reference is made to the accompanying drawing which illustrates an apparatus embodying the invention and which further illustrates one example of an apparatus which is suitable for use in carrying out the process embodying the present invention.

In the drawing, wherein like symbols refer to like or corresponding parts throughout the several views,

Figure 1 is a side elevation of the device taken partly in section and with parts broken away,

Figure 2 is a partial perspective view of the device with the parts drawn out for clearness, and

Figure 3 is a top plan view of the complete device shown in Figure 1.

The example of the apparatus illustrated is shown as consisting mainly of the following principal elements: A casing 23 or other means and adapted to be operated when the device has been lowered into position within the well hole to permit the cognate fluids of the formation to discharge into the empty chamber or conduit provided by the pipe 23. The apparatus is also illustrated as preferably comprising a packer 15 or other means for sealing off the formation to be tested from the pressure of the head of mud-laden fluid within the well bore. The invention is also illustrated as comprising an inlet member 12 below the packer and valve, through which the fluids from the formation to be tested may be permitted to discharge into the conduit or chamber formed by the casing or pipe 23 when the valve is operated as later described.

Referring more particularly to the drawing, the body 4 preferably formed of a body of steel or other appropriate material traversed longitudinally by one or more passages 5 and 6 here shown to be two in number and disposed diametrically of the body 4, which in the instance illustrated is round in cross-section.

The body 4 is provided with pins 7 and 8 extending respectively upwardly and downwardly therefrom, these pins being turned from a block of material of which the body portion is a part, or being otherwise produced, and the upper pin 7 being smaller in diameter as compared with the diameter of the lower pin 8. The lower pin 8 is of greater diameter as it is also traversed by passages which are continuations of the passages 5 and 6 in the body part 4. These passages converge downwardly and they both communicate at their base with the interior of the hollow adjusting sleeve 9 which is internally threaded at both ends to engage with external threads 10 upon the lower end of the pin 8 and with similar external threads 11 upon the upper end of the inlet member 12. This inlet member 12 is indicated as preferably in the form of a hollow perforated pipe or strainer which, when the invention is employed to test a well through the employment of a so-called "rat-hole", is adapted to fit into the "rat hole" and support the sides of said "rat hole" when the pressure of the mud-laden fluid within the well is sealed off from said hole as hereafter described. This strainer is closed at its lower end by the plug 13 which may be removable and for this purpose it is provided with screw threads indicated at 14, for taking into complemental threads upon the lower end of the strainer. The pin 8 is also of greater diameter in order to better receive the packer member 15. The packing member 15 is indicated as being of frusto-conical shape so that it is adapted to wedge within the upper end of the "rat hole" within the well bore and thus seal the formation below from the pressure of the mud-laden fluid within the well. For this purpose, the packer member 15 may, for example, be composed of rubber, lead or other appropriate material. The wider part of this packer member is disposed upwardly and the lower smaller end ... end of the adjust-

chamber. This closing of the conduit is effected by an operator at the top of the well who can open and close the conduit at will. Following the entrance of the cognate fluid into the empty conduit of chamber, the apparatus may be elevated to the top of the well with the entrapped fluid content. The conduit being closed, the mud-laden fluid in the well is prevented from entering the conduit and contaminating the sample or otherwise interfering with the testing process.

The present invention also preferably embodies a means by which the formation to be tested may be sealed off from the hydraulic pressure of the mud-laden fluid standing within the well during the testing operation, and also includes a method and means by which the hydraulic pressure of the mud-laden fluid in the well may be reimposed upon the formation after the completion of the testing operation without either of these steps requiring any removal of mud-laden fluid from the well bore.

The present invention also provides a method and apparatus by which a formation may be tested through the penetration of the lower end of the testing apparatus into a so-called "rat hole", or an extension of the well bore of reduced diameter, the bottom of the hole thus leaving the hole provided with a seat above the formation to be tested which may be employed for setting of water or other string of casing if the test on the well establishes the productivity of a formation.

Various further objects and advantages of the present invention will appear from a description of a preferred form or example of the present invention. For this purpose, reference is made to the accompanying drawing which illustrates an apparatus embodying the invention and which further illustrates one example of an apparatus which is suitable for use in carrying out the process embodying the present invention.

In the drawing, wherein like symbols refer to like or corresponding parts throughout the several views,

Figure 1 is a side elevation of the device taken partly in section and with parts broken away,

Figure 2 is a partial perspective view of the device with the parts drawn out for clearness, and

Figure 3 is a top plan view of the complete device shown in Figure 1.

The example of the apparatus illustrated is shown as consisting mainly of the following principal elements: A casing 23 or other means adapted to provide an empty chamber or conduit which may be lowered into a well bore and, when so lowered, provide an empty chamber adjacent the formation to be tested. In the preferred form of the invention where this member comprises a casing 23, there will thus be provided an empty chamber or conduit extending from the formation to be tested up to the top of the well hole. The invention also comprises as the second major element a valve including the valve body 4 and head or bushing 19, which is adapted to normally close such chamber or conduit 23 from communication with the mud-laden fluid within the well 12 below the packer and valve, through which the fluids from the formation to be tested may be permitted to discharge into the conduit or chamber formed by the casing or pipe 23 when the valve is operated as later described.

Referring more particularly to the drawing, the body 4 preferably formed of a body of steel or other appropriate material traversed longitudinally by one or more passages 5 and 6 here shown to be two in number and disposed diametrically of the body 4, which in the instance illustrated is round in cross-section.

The body 4 is provided with pins 7 and 8 extending respectively upwardly and downwardly therefrom, these pins being turned from a block of material of which the body portion is a part, or being otherwise produced, and the upper pin 7 being smaller in diameter as compared with the diameter of the lower pin 8. The lower pin 8 is of greater diameter as it is also traversed by passages which are continuations of the passages 5 and 6 in the body part 4. These passages converge downwardly and they both communicate at their base with the interior of the hollow adjusting sleeve 9 which is internally threaded at both ends to engage with external threads 10 upon the lower end of the pin 8 and with similar external threads 11 upon the upper end of the inlet member 12. This inlet member 12 is indicated as preferably in the form of a hollow perforated pipe or strainer which, when the invention is employed to test a well through the employment of a so-called "rat-hole", is adapted to fit into the "rat hole" and support the sides of said "rat hole" when the pressure of the mud-laden fluid within the well is sealed off from said hole as hereafter described. This strainer is closed at its lower end by the plug 13 which may be removable and for this purpose it is provided with screw threads indicated at 14, for taking into complemental threads upon the lower end of the strainer. The pin 8 is also of greater diameter in order to better receive the packer member 15. The packing member 15 is indicated as being of frusto-conical shape so that it is adapted to wedge within the upper end of the "rat hole" within the well bore and thus seal the formation below from the pressure of the mud-laden fluid within the well. For this purpose, the packer member 15 may, for example, be composed of rubber, lead or other appropriate material. The wider part of this packer member is disposed upwardly and the lower smaller end is disposed against the upper end of the adjusting sleeve 9 which forms an abutment for the packer member. The upper wide end of the packer member 15 fits against a shoulder 16 at the lower end of the body member 4. This shoulder is beveled or under-cut with its outer edge depending below its inner circular edge. This permits the upper end of the packer member 15 to be forced into the recess thus formed in the shoulder 16 when pressure is put upon the packer member 15 and the effect is to hold the packer member more firmly and to give it a stronger backing and abutment to enable the

packer member to be squeezed into the rat-hole and form a tight fit.

The upper divergent ends of the passages 5 and 6 open at opposite sides of the narrow upper pin 7 and these passages are adapted to register with similar passages 17 and 18 extending lengthwise through the head or bushing 19 of the valve which head is rotatably mounted upon the pin 7 and is secured thereto as by the lock nuts 20 and 21 screwed upon the upper externally threaded end of the pin 7 which is made of a length to project above the upper end of the bushing 19. This bushing 19 is also preferably cylindrical or substantially in the form of a barrel and is provided with external threads 22 upon its upper end for receiving the pipe or casing 23 indicated in dotted lines in Figure 1. The passages 17 and 18 open out upon the upper end of the bushing 19 and communicate with the interior of the casing 23.

The lower end of the bushing 19 is provided with a slot 24 to receive the pin 25 provided with the threaded shank which is secured in a threaded opening in the upper end of the body member 4.

It will be seen from the foregoing description that I have provided a valve at the end of the casing 23 which can be manipulated as desired from the surface of the well to close or open the empty chamber or conduit provided by the pipe or casing 23. The slot 24 and pin 25 between the head 19 and body 4 of the valve provides a means by which the relative rotation between the head and body of the valve may be limited in order to facilitate registering the passages in the head with those in the body of the valve.

In the use of the preferred apparatus of the invention and in practicing the preferred method of testing formations through use of said apparatus, the device is let down through the well but before so doing care should be taken to close the valve by rotating the bushing 19 to such position that the passages 17 and 18 thereof are out of registry with the complemental passages 5 and 6 in the body member 4 and lower pin 8. In this condition of the parts any fluid that may be standing in the well will be prevented from entering the casing 23, as, of course, the entry of such fluid would interfere with the purity of the sample sought.

In this manner there is thus established an empty chamber or conduit adjacent the formation to be tested, without the necessity of removing the mud-laden fluid from the well hole. It should be pointed out that the entrance of the mud-laden fluid into the empty chamber or conduit of the pipe or casing 23 should be prevented during the lowering of the apparatus in the well in order to prevent the pressure of the mud-laden fluid from filling up this empty chamber or conduit, whereby it would impose its hydraulic head upon the formation to be tested when the valve is opened and thus defeat the object of the testing method.

The packer 15 is lowered into the small hole at the bottom of the well which is called the rat-hole, and it is forced into this small hole, compressing the ... brought into alignment and when this condition occurs, the fluid in the rat-hole will enter the strainer pipe 12 and ascend through the passages in the pin 8, body member 4 and bushing 19 into the casing 23. It will be obvious that if the pressure of the cognate fluids within the formation is sufficiently high that production may then take place through the casing 23. When the pressure is not sufficient for this purpose and when a sample of sufficient mass has been received the bushing 19 is again rotated in the opposite direction in order to move the passages out of registry and trap the sample in pipe 23. The entire device may be then lifted to the surface and the possible production may be measured from the sand tested.

The strainer pipe 12 may or may not be used and the valve and packer as constructed may be connected in the same manner as a bit to the drill stem and run into the hole in the same manner, making it possible within a very few minutes to gain the sample and to pull it to the surface.

It will be apparent that the packer 25 operates to remove the pressure of the mud-laden fluid in the well from the cognate fluids of the formation, which are then free to discharge into the empty conduit formed by the casing 23 whenever the valve is opened to permit communication between the formation and this empty conduit. It will be further seen that as soon as the valve is closed and the testing apparatus started to be removed from the formation, thus releasing the packer, the pressure of this mud-laden fluid is again immediately reimposed upon the formation, thus preventing further discharge of the fluids of such formation. In this manner the well is always under control and no danger of blow-outs encountered. Moreover, the conduit being positively closed, during the withdrawal of the apparatus, the mud-laden fluid within the well cannot contaminate the sample or otherwise interfere with the testing operation.

It is obvious that various changes and modifications may be made in the details of construction and design of the above specifically described embodiment of the apparatus of this invention without departing from the spirit thereof, and the particular embodiment of the method of the present invention is not limited nor dependent upon the use of the particular apparatus described nor is it limited to the particular details of the preferred method, but both method and apparatus of the present invention include all such changes, modifications, substitutions and equivalents as come within the scope of the following appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States is:

1. A well testing device comprising a body part having passages therethrough open at the bottom to receive a sample of the material to be tested, a packer member carried by said body part, and a bushing carried by the casing and rotatable with respect to said body part having passages therein ... the body

bushing 19 is also preferably cylindrical or substantially in the form of a barrel and is provided with external threads 22 upon its upper end for receiving the pipe or casing 23 indicated in dotted lines in Figure 1. The passages 17 and 18 open out upon the upper end of the bushing 19 and communicate with the interior of the casing 23.

The lower end of the bushing 19 is provided with a slot 24 to receive the pin 25 provided with the threaded shank which is secured in a threaded opening in the upper end of the body member 4.

It will be seen from the foregoing description that I have provided a valve at the end of the casing 23 which can be manipulated as desired from the surface of the well to close or open the empty chamber or conduit provided by the pipe or casing 23. The slot 24 and pin 25 between the head 19 and body 4 of the valve provides a means by which the relative rotation between the head and body of the valve may be limited in order to facilitate registering the passages in the head with those in the body of the valve.

In the use of the preferred apparatus of the invention and in practicing the preferred method of testing formations through use of said apparatus, the device is let down through the well but before so doing care should be taken to close the valve by rotating the bushing 19 to such position that the passages 17 and 18 thereof are out of registry with the complemental passages 5 and 6 in the body member 4 and lower pin 8. In this condition of the parts any fluid that may be standing in the well will be prevented from entering the casing 23, as, of course, the entry of such fluid would interfere with the purity of the sample sought.

In this manner there is thus established an empty chamber or conduit adjacent the formation to be tested, without the necessity of removing the mud-laden fluid from the well hole. It should be pointed out that the entrance of the mud-laden fluid into the empty chamber or conduit of the pipe or casing 23 should be prevented during the lowering of the apparatus in the well in order to prevent the pressure of the mud-laden fluid from filling up this empty chamber or conduit, whereby it would impose its hydraulic head upon the formation to be tested when the valve is opened and thus defeat the object of the testing method.

The packer 15 is lowered into the small hole at the bottom of the well which is called the rat-hole, and it is forced into this small hole, compressing the packer and thereby excluding all water from the well above. This squeezing or forcing of the packer 15 into the rat-hole also anchors the body against rotary or turning movement. Therefore, the pipe or casing 23 may be rotated to cause similar rotation of the bushing 19 to effect registry of the passages 17 and 18 with the passages 5 and 6. The striking of the pin 25 against the other wall of the slot 24 will indicate to the operator when the passages have been trap the sample in pipe 23. The entire device may be then lifted to the surface and the possible production may be measured from the sand tested.

The strainer pipe 12 may or may not be used and the valve and packer as constructed may be connected in the same manner as a bit to the drill stem and run into the hole in the same manner, making it possible within a very few minutes to gain the sample and to pull it to the surface.

It will be apparent that the packer 25 operates to remove the pressure of the mud-laden fluid in the well from the cognate fluids of the formation, which are then free to discharge into the empty conduit formed by the casing 23 whenever the valve is opened to permit communication between the formation and this empty conduit. It will be further seen that as soon as the valve is closed and the testing apparatus started to be removed from the formation, thus releasing the packer, the pressure of this mud-laden fluid is again immediately reimposed upon the formation, thus preventing further discharge of the fluids of such formation. In this manner the well is always under control and no danger of blow-outs encountered. Moreover, the conduit being positively closed, during the withdrawal of the apparatus, the mud-laden fluid within the well cannot contaminate the sample or otherwise interfere with the testing operation.

It is obvious that various changes and modifications may be made in the details of construction and design of the above specifically described embodiment of the apparatus of this invention without departing from the spirit thereof, and the particular embodiment of the method of the present invention is not limited nor dependent upon the use of the particular apparatus described nor is it limited to the particular details of the preferred method, but both method and apparatus of the present invention include all such changes, modifications, substitutions and equivalents as come within the scope of the following appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States is:

1. A well testing device comprising a body part having passages therethrough open at the bottom to receive a sample of the material to be tested, a packer member carried by said body part, and a bushing carried by the casing and rotatable with respect to said body part having passages therein adapted to register with the passages in the body part to receive the sample to be tested, said packer adapted to be positively pressed against the walls of the formation to seal off the same.

2. A well testing device comprising a body part having a passage therein open at its bottom to receive the material to be tested, a packer adjoining said body part, a bushing having a passage adapted to register with the passage in the body part and connected for manipulation to the cas-

ing, and means to restrict the rotary movement of said bushing, said passages being constructed to receive the material to be tested, said packer adapted to be positively pressed against the walls of the formation to seal off the same.

3. A well testing device comprising a body part having a passage extending therethrough and opening at the ends thereof, a packer associated with said body part, a pin extending upwardly from said body part, a bushing rotating on said pin and having a passage therein extending from end to end and adapted to register with the passage in said body part, said bushing having means to receive a casing in communication with the passage in the bushing, and means to confine said bushing on the pin, said passages being constructed to receive the material to be tested.

4. A well testing device comprising a body part having pins extending from the upper and lower ends thereof, the lower pin being of greater diameter than the upper, said body part and lower pin having a continuous passage therein open at its upper and lower ends, a packer extending about the lower pin, and a bushing mounted for rotation on the upper pin being connected to a string of casing and having a passage therein adapted to be moved into and out of registry with the passage in said body part and lower pin.

5. A well testing device comprising a body part having an upper pin, a bushing fitted to rotate about said upper pin and having a slot at its lower end with threads at its upper end to receive a casing, said pin projecting upwardly above the bushing and having means to hold the bushing on the pin, a stop member carried by said body part and projecting in the slot at the lower end of the bushing, said body part having a passage therein, said body part and bushing having passages adapted to register, and a casing carried by said body part.

6. A well testing device comprising a body part having a lower pin projecting therefrom and forming a shoulder with the body part, said shoulder being under-cut, a downwardly tapering packer surrounding said pin for engaging against said under-cut shoulder, and means at the lower end of said pin for constituting an abutment for said packer, said body part and pin having a passage therethrough, and means adjoining the upper end of said body part for opening and closing the communication of this passage with the casing above.

7. A well testing device comprising a body part having a pin extending from the lower part thereof, said body part and pin having a passage therethrough, a packer extending about said pin, an adjusting sleeve on the lower end of said pin, a perforated pipe secured to the lower end of said sleeve, a plug in the bottom of said perforated pipe, and means above the body part for regulating the communication of the passage with the interior of the casing above.

8. A method of testing the productivity of a formation encountered in a well containing drilling fluid, which includes lowering an empty string of pipe into the well through the drilling fluid raising the pipe so closed to remove an entrapped sample and the packer from the well.

9. Apparatus for testing a well comprising a string of pipe to be lowered into a well having an inlet at its lower end and carrying a packer adapted to be positively pressed against the walls of the formation to seal off the same above the inlet, and a valve for the inlet positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

10. Apparatus for testing a well comprising a string of pipe to be lowered into the well, a packer carried by the pipe said packer adapted to be positively pressed against the walls of the formation to seal off the same and means at the lower end of the pipe to receive a sample from the well including an inlet and a valve for controlling the inlet, the valve being positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

11. Apparatus for testing a well containing drilling fluid, which includes an empty string of pipe to be lowered in the well to adjacent the formation to be tested, means at the lower end of the pipe to receive a sample from the formation including an inlet opening into the pipe and a valve for controlling the inlet, and means carried by the pipe for sealing the well above the inlet said means consisting of a packer adapted to be positively pressed against the walls of the formation to seal off the same, the valve being positively controlled by movement of the pipe.

12. Apparatus for testing a formation encountered in a well containing drilling fluid, which includes a single string of pipe to be lowered into the well to adjacent the formation to be tested, a valved inlet at the lower end of the pipe positively controlled from the top of the well by movement of the pipe and a packer carried by the pipe above the inlet, said packer being adapted to be positively pressed against the walls of the formation to seal off the same.

13. Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, which includes an empty string of pipe to be lowered into the well to adjacent the formation to be tested, a packer carried by the pipe adapted to be positively pressed against the walls of the formation to seal off the same, means at the lower end of the pipe to receive a sample from the formation including an inlet opening into the pipe and a valve structure for controlling the inlet, the valve structure including a plurality of relatively movable parts one of which is secured to the pipe and another of which is connected to the packer.

14. Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, which includes a single empty string of pipe to be lowered into the well to adjacent the formation to be tested, means lowered into the well by said string of pipe for sealing off the drilling fluid from the formation to be tested, said sealing means being adapted to

end to end and adapted to register with the passage in said body part, said bushing having means to receive a casing in communication with the passage in the bushing, and means to confine said bushing on the pin, said passages being constructed to receive the material to be tested.

4. A well testing device comprising a body part having pins extending from the upper and lower ends thereof, the lower pin being of greater diameter than the upper, said body part and lower pin having a continuous passage therein open at its upper and lower ends, a packer extending about the lower pin, and a bushing mounted for rotation on the upper pin being connected to a string of casing and having a passage therein adapted to be moved into and out of registry with the passage in said body part and lower pin.

5. A well testing device comprising a body part having an upper pin, a bushing fitted to rotate about said upper pin and having a slot at its lower end with threads at its upper end to receive a casing, said pin projecting upwardly above the bushing and having means to hold the bushing on the pin, a stop member carried by said body part and projecting in the slot at the lower end of the bushing, said body part having a passage therein, said body part and bushing having passages adapted to register, and a casing carried by said body part.

6. A well testing device comprising a body part having a lower pin projecting therefrom and forming a shoulder with the body part, said shoulder being under-cut, a downwardly tapering packer surrounding said pin for engaging against said under-cut shoulder, and means at the lower end of said pin for constituting an abutment for said packer, said body part and pin having a passage therethrough, and means adjoining the upper end of said body part for opening and closing the communication of this passage with the casing above.

7. A well testing device comprising a body part having a pin extending from the lower part thereof, said body part and pin having a passage therethrough, a packer extending about said pin, an adjusting sleeve on the lower end of said pin, a perforated pipe secured to the lower end of said sleeve, a plug in the bottom of said perforated pipe, and means above the body part for regulating the communication of the passage with the interior of the casing above.

8. A method of testing the productivity of a formation encountered in a well containing drilling fluid, which includes lowering an empty string of pipe into the well through the drilling fluid to adjacent the formation, the pipe carrying a packer and having a valved inlet at its lower end which is closed while the pipe is being lowered, setting the packer above the formation to seal off the drilling fluid from the formation, opening the valved inlet after the packer is set to permit cognate fluid from the formation to enter the pipe, closing the valved inlet against the entrance of fluid from the well by movement of the pipe, string of pipe to be lowered into the well, a packer carried by the pipe said packer adapted to be positively pressed against the walls of the formation to seal off the same and means at the lower end of the pipe to receive a sample from the well including an inlet and a valve for controlling the inlet, the valve being positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

11. Apparatus for testing a well containing drilling fluid, which includes an empty string of pipe to be lowered in the well to adjacent the formation to be tested, means at the lower end of the pipe to receive a sample from the formation including an inlet opening into the pipe and a valve for controlling the inlet, and means carried by the pipe for sealing the well above the inlet said means consisting of a packer adapted to be positively pressed against the walls of the formation to seal off the same, the valve being positively controlled by movement of the pipe.

12. Apparatus for testing a formation encountered in a well containing drilling fluid, which includes a single string of pipe to be lowered into the well to adjacent the formation to be tested, a valved inlet at the lower end of the pipe positively controlled from the top of the well by movement of the pipe and a packer carried by the pipe above the inlet, said packer being adapted to be positively pressed against the walls of the formation to seal off the same.

13. Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, which includes an empty string of pipe to be lowered into the well to adjacent the formation to be tested, a packer carried by the pipe adapted to be positively pressed against the walls of the formation to seal off the same, means at the lower end of the pipe to receive a sample from the formation including an inlet opening into the pipe and a valve structure for controlling the inlet, the valve structure including a plurality of relatively movable parts one of which is secured to the pipe and another of which is connected to the packer.

14. Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, which includes a single empty string of pipe to be lowered into the well to adjacent the formation to be tested, means lowered into the well by said string of pipe for sealing off the drilling fluid from the formation to be tested, said sealing means being adapted to be positively pressed against the walls of the formation to seal off the same, means at the lower end of said string of pipe to receive a sample from the formation including an inlet opening into said pipe and a valve structure for controlling the inlet, said valve structure including a part connected to said sealing means and a part connected to said pipe.

15. Apparatus for testing the productivity of a formation encountered in a well containing

drilling fluid, comprising a single empty string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to be tested, a packer lowered into the well by said string of pipe for sealing off the drilling fluid from the formation to be tested, said packer adapted to be positively pressed against the walls of the formation to seal off the same, means at the lower end of said string of pipe to receive fluid from said formation including an inlet opening into said pipe below said packer and a valve structure for controlling the inlet, said valve structure having a relatively stationary part connected to the packer and a relatively movable part connected to the pipe.

16. Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, comprising a single empty string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to be tested, a packer carried by the pipe for sealing off the well above the formation an inlet below the packer opening into the pipe, said packer adapted to be positively pressed against the walls of the formation to seal off the same, and a valve for the inlet, the setting of the packer and the operation of the valve being positively controlled by movement of the pipe.

17. Apparatus for testing a well containing drilling fluid, comprising a single string of pipe to be lowered into the well through the drilling fluid, said pipe being closed against the entrance of the drilling fluid, means at the lower end of the pipe for receiving a sample including an inlet opening into the pipe, means carried by the pipe for sealing the well above the inlet, said sealing means adapted to be positively pressed against the walls of the formation to seal off the same, and a valve for the inlet that may be positively opened and closed by movement of the pipe while the well is sealed above the inlet.

18. A method of testing the productivity of a formation encountered in a well containing drilling fluid involving the insertion of only a single string of pipe into the well to make a test, which includes lowering a test string into the well through the drilling fluid with a packer carried by the string and a valve inlet at the lower end of the string closed against the entrance of fluid from the well, setting the packer above the formation and opening the valve to permit cognant fluid from the formation to enter the inlet, closing the valve to prevent the subsequent entrance of fluid from the well through the inlet and releasing the packer, and raising the test string with the inlet closed against entrance of fluid from the well to remove an entrapped sample.

19. An apparatus for testing the productivity of a formation in a well containing drilling fluid, comprising a string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to receive a fluid sample therefrom and to be raised out of the well to remove the entrapped sample, said pipe being closed against the flow of the drilling fluid as the pipe is lowered into the well, a packer carried by the pipe as the pipe is lowered into the well and adapted to be seated by manipulation of the pipe to seal off the well above the formation, said packer adapted to be positively pressed against the walls of the formation to seal off the same, an inlet to the pipe communicating with the well below the point at which the packer seals off the well, and means for controlling the inlet to permit fluid from the formation to enter the pipe while the packer is set and to prevent fluid from entering the pipe after the packer is released and the pipe is being raised out of the well.

JOHN T. SIMMONS.

[PLAINTIFF'S EXHIBIT NO. 2.]

390

DEPARTMENT OF COMMERCE
United States Patent Office

To all persons to whom these presents shall come, Greeting:

THIS IS TO CERTIFY that the annexed is a true copy from the records of this office of the File Wrapper and Contents, in the matter of the

Letters Patent of
John T. Simmons, Assignor, by
Direct and Mesne Assignments, to
Erle P. Halliburton,

Number 1,930,987, Granted October 17, 1933,

for

Improvement in Methods and Apparatus for Testing the Productivity of Formations Encountered in Wells.

[Seal] In Testimony Whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this thirtieth day of October, in the year of our Lord one thousand nine hundred and thirty-five and of the Independence of the United States of America the one hundred and sixtieth.

Attest:

D E Wilson
Chief of Division.

Conway P. Coe
Commissioner of Patents.

1930987

NUMBER (Series of 1925) PATENT NO.
87323 1926 DATED OCT 17 1933
DIV. 38 EX'R'S BOOK) 109

Name JOHN T. SIMMONS 9
by direct and mesne assigts
Assn ^ to ~~2 to Frank N. Henderson, of El Dorado, Arkansas.~~ Erle P. Halliburton, ~~of~~ Los Angeles, California

~~of~~ EL DORADO,
State of ARK.~~ANSAS~~
Invention Method and Apparatus for Testing the Productivity of Formations Encountered in Wells
~~WELL TESTING DEVICES~~

ORIGINAL
APPLICATION FILED COMPLETE FEB 10, 1926

Parts of Application Filed

Petition, Specification, Oath, First Fee $20, XXXXXXXXXXXX	FEB 9, 1926
I SHEET DRAWING	FEB 10, 1926

Examined and passed for Issue Sept 13, 1933
C. F. Krafft Exr. Div. 38

Notice of Allowance SEP 13 1933 , 192
By Commissioner.

Final Fee $30 Sept 19, 1933

RENEWED

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....

....

Reexam'd and passed for Issue ...., 192

.... Exr. Div. ....

Notice of Allowance ...., 192

By Commissioner.

Final Fee ...., 192

Attorney ~~WILKINSON & GIUSTA OURAY BLDG CITY~~

708

Lyon and Lyon ^ National City Bank Building, Los Angeles, Calif.

Associate Attorney ~~J. M. Mason McGill Bldg, City~~

Mason & Mason, ~~Work. Loan & Trust Bldg.,~~

Metropolitan Bank Bldg.,

Washington D. C.

No. of Claims Allowed 19 Print Claims ....in O. G. Class 166 - 1

Title as Allowed Method and Apparatus for Testing the Productivity of Formations Encountered in Wells

....

....

[In margin]: Division of App., No. ....

filed ...., 19........

Serial No. 10787 Paper No. 1
Application
87323

PETITION

[Written]: 20 H

[Stamped]: $............ REC'D FEB 9 1926 C. C. U. S. PAT. OFFICE

To the Commissioner of Patents:

Your petitioner John T. Simmons, a citizen of the United States residing at El Dorado, in the County of Union, and State of Arkansas, whose post-office address is P. O. Box 1411, El Dorado, Arkansas, prays that Letters-Patent may be granted to him for the improvements in

WELL TESTING DEVICES

as set forth in the annexed specification.

And he hereby appoints the firm of WILKINSON & GIUSTA, of Washington, D. C., and Denver, Colorado, composed of Ernest Wilkinson and John Stephen Giusta, Registration No. 238, his attorneys, with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to sign the drawings, to receive the Patent, and to transact all business in the Patent Office connected therewith.

☞ Each Inventor's FULL name here

John T. Simmons

....

OATH

tate of Arkansas }
ounty of Pulaski } ss:

John T. Simmons, the above-named petitioner...., being
ily sworn (affirmed), deposes and says that he is a cit-
en.... of the United States and resident.... of El Dorado,
rkansas and that he verily believes himself to be the
iginal, first and sole inventor of the improvement in
ELL TESTING DEVICES described and claimed in
e annexed specification; that he does not know and
es not believe that the same was ever known or used
fore his invention or discovery thereof; or patented or
scribed in any printed publication in any country be-
re his invention or discovery thereof, or more than
o years prior to this application; or patented in any
intry foreign to the United States on an application
d more than twelve months before this application;
in public use or on sale in the United States for more
n two years prior to this application; and that (no)
lication for patent on said improvement has been
d by him or his representatives or assigns in any
intry foreign to the United States................................

....

☞ Each Inventor's FULL name here

John T. Simmons
....

worn to and subscribed before me at El Dorado, Ar-
sas, this 2nd day of February, 1926

Seal] Jos. H. Schneider
(Signature of Notary Public)

ere must be an OFFICIAL SEAL here]

ritten]: Exp 6/1/29

87 1

~~SPECIFICATION.~~

[Written in margin]: Per A " '

~~TO ALL WHOM IT MAY CONCERN:~~

~~Be it known that I, John T. Simmons, a citizen of the United States, residing at El Dorado, in the County of Union, and State of Arkansas, have invented certain new and useful improvements in~~

the Productivity of Formations
Method and Apparatus for Encountered in Wells
^ ~~WELL~~ TESTING ^ ~~DEVICES~~

~~and I do hereby declare the following to be a full, clear and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.~~

87 2

[Written]: Insert A 1 4 pp

[Written in margin]: Sub. A 1

~~The present invention relates to improvements in well testing devices and has for an object to provide an im-~~

~~gr (1) point (1)~~

~~proved device known as a "rat hole test packer" useful for securing samples of the gas and oil at various strata in the well being drilled.~~

~~The device will be found useful for both oil and gas wells and will correctly indicate the nature of the field before setting a permanent string of casing.~~

~~A further object of the invention is to provide an inexpensive, simple and compact device which may be conveniently and quickly lowered into the well and through~~

~~gr 1 pt 2~~

~~the rat hole opening, which will (exclude the entrance of fluid from the well) as it is being passed downwardly, which may be readily manipulated to permit the entrance of the oil, gas and fluid to be tested and which will effectually retain this sample during the drawing of the device again to the surface.~~

87 3

[In margin]: Hws ~~(InsA 1)~~ ~~(4¼pp)~~

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views,

Figure 1 is a side elevation of the device taken partly in section and with parts broken away,

Figure 2 is a partial perspective view of the device with the parts drawn out for clearness, and

Figure 3 is a top plan view of the complete device shown in Figure 1.

[Written]: (26)

A 2

[In margin]: A 2

[In margin]: Per A " "

the body

Referring more particularly to the drawings, ^ preferably formed of

4 ^ ~~designates~~ a body of steel or other appropriate material traversed longitudinally by one or more passages 5 and 6 here shown to be two in number and disposed diametrically of the body 4, which in the instance illustrated is round in cross-section.

The body 4 is provided with pins 7 and 8 extending respectively upwardly and downwardly therefrom, these pins being turned from a block of material of which the body portion is a part, or being otherwise produced, and the upper pin 7 being smaller in diameter as compared with the diameter of the lower pin 8. The lower pin 8 is

87 4

f greater diameter as it is also traversed by passages hich are continuations of the passages 5 and 6 in the ody part 4. These passages converge downwardly and ey both communicate at their base with the interior of e hollow adjusting sleeve 9 which is internally threaded both ends, to engage with external threads 10 upon the wer end of the pin 8 and with similar external threads 11

[In margin]: Insert A 3

(2)

on the upper end of the ^ hollow perforated pipe or
A 3

[In margin]: Insert A 4

rainer ~~12~~ ^ . This strainer ~~12~~ is closed at its lower end
A 4

the plug 13 which may be removable and for this purpose it is provided with screw threads indicated at 14, r taking into complemental threads upon the lower end the strainer. The pin 8 is also of greater diameter

[In margin]: Insert A 5

in order to better receive the ~~frusto conical~~ packer mem-
(6)
ber 15, ^ of rubber, lead or other appropriate material.
A 5

The wider part of this packer member is disposed upwardly and the lower smaller end is disposed against the upper end of the adjusting sleeve 9 which forms an abutment for the packer member. The upper wide end of the packer member 15 fits against a shoulder 16 at the lower end of the body member 4. This shoulder is beveled or under-cut with its outer edge depending below its inner circular edge. This permits the upper end of the packer member 15 to be forced into the recess thus formed in the shoulder 16 when pressure is put upon the packer member 15 and the effect is to hold the packer member more firmly and to give it a stronger backing and abutment to enable the packer member to be squeezed into the rat-hole and form a tight fit.

(X)

87 5

[In margin]: Per A " "

The upper divergent ends of the passages 5 and 6 open at opposite sides of the narrow upper pin 7 and these passages are adapted to register with similar pas-

The head or

ages 17 and 18 extending lengthwise through ~~a~~ ^

of the valve head

bushing 19 ^ which ^ is rotably mounted upon the pin 7 and is secured thereto as by the lock nuts 20 and 21 screwed upon the upper externally threaded end of the pin 7 which is made of a length to project above the upper end of the bushing 19. This bushing 19 is also preferably cylindrical or substantially in the form of a barrel and is provided with external threads 22 upon its upper end for receiving the pipe or casing 23 indicated in dotted lines in Figure 1. The passages 17 and 18 open out upon the upper end of the bushing 19 and communicate with the interior of the casing 23.

The lower end of the bushing 19 is provided with a slot

the

24 to receive the pin 25 provided with / threaded shank which is secured in a threaded opening in the upper end of the body member 4.

[Written]: (10) A 6—

[In margin]: Insert A 6 Insert A 7 Per A

preferred apparatus of the (2)

In the use of the ^ invention ^, the device is ~~at-~~

A 7

~~tached to a string of casing of which 23 is a part and~~

Serial No. 87.323 Paper No. 3

Amendment A and Affidavit.

[Stamped]: U. S. Patent Office MAR 25 1926 DIVISION 38

[Written]: Brg new

[Stamped]: APPLICATION DIV. MAR 24 1926 U. S. PATENT OFFICE

10790

IN THE UNITED STATES PATENT OFFICE

Re application of
John T. Simmons,
WELL TESTING DEVICES,
Ser. No. 87323,
Filed Feb. 10, 1926.

- - - - - - - -

Los Angeles, Calif.
March 9th, 1926.

Commissioner of Patents,
Washington, D. C.

Sir:–

Kindly amend the above entitled application as follows:

In the preamble and Petition, change the title from "WELL TESTING DEVICES to—METHOD AND

PARATUS FOR TESTING THE PRODUCTIV-
Y OF FORMATIONS ENCOUNTERED IN
ELLS—.

Cancel Page 2 of the specification and substitute there- the following:–

Written]: Hws

In margin]: (A 1)

The present invention relates to methcds and appara- for testing the productivity of formations encountered rilling oil and other deep wells, and refers particularly nethods and apparatus employed when such wells are led by the rotary method.

n the rotary method of drilling wells, the well is kept l with a mud-laden fluid. This mud-laden fluid is em- ed for the purpose of carrying away the detritus ned by the cutting bit and for maintaining a hydraulic sure upon the sides of the hole, which prevents the from caving. In most wells drilled by the rotary ess, it is impossible, without danger to the hole, to ove the mud-laden fluid without providing some other ort to conserve the hole bore.

87 13

let down through the well/ but before so doing care

[In margin]: " "

close the valve by rotating

should be taken to ^ ~~rotate~~ the bushing 19 to such position that the passages 17 and 18 thereof are out of registry with the complemental passages 5 and 6 in the body member 4 and lower pin 8. In this condition of the parts any fluid that may be standing in the well will be prevented from entering the casing 23, as, of course, the entry of such fluid would interfere with the purity of the sample sought.

87 6

-5-

10799

[In margin]: Insert A 8

(11) A 8—

The packer 15 is lowered into the small hole at the bottom of the well which is called the rat-hole, and it is forced into this small hole, compressing the packer and thereby excluding all water from the well above. This squeezing or forcing of the packer 15 into the rat-hole also anchors the body against rotary or turning movement. Therefore, the pipe or casing 23 may be rotated to cause similar rotation of the bushing 19 to effect registry of the passages 17 and 18 with the passages 5 and 6. The striking of the pin 25 against the other wall of the slot 24 will indicate to the operator when the pas-

es have been brought into alignment and when this
dition occurs, the fluid in the rat-hole will enter the
iner pipe 12 and ascend through the passages in the
8, body member 4 and bushing 19 into the casing

In margin]: Insert A 9 JK JK. 15

When
^ ~~When~~ a sample of sufficient mass has been re-
A 9
ed the bushing 19 is again rotated in the opposite
ction in order to move the passages out of registry
trap the sample in pipe 23. The entire device may
hen lifted to the surface and the possible production
be measured from the sand tested.

In margin]: Per A " "

valve and packer
he strainer pipe 12 may or may not be used and the ^
ee as constructed may be connected in the same man-
to the drill stem
as a bit ^ and run ~~promptly~~ into the hole in the same
ner, making it possible within a very few minutes
ain the sample and to pull it to the surface.

n margin]: Insert A 10

7)—A 10—

is obvious that various changes and modifications
be made in the details of construction and design
of the apparatus
e above specifically described embodiment ^ of this

n margin]: Sub. A 11 (8)

ation without departing from the spirit thereof, ~~such~~

87 7

[In margin]:

The hydraulic pressure of the mud-laden fluid in the well is very great, being often in excess of two thousand pounds per square inch. In most instances, this pressure is in excess of the head upon the cognate fluids, either oil, water or gas, encountered in the formations penetrated by the drill. Under these circumstances, while drilling there may be no indication whatever at the surface of the well of the productivity or even existence of such cognate fluids. It is therefore necessary to perform a special testing operation whenever it is desired to determine whether such a formation contains a fluid which upon removal of the pressure of the mud-laden fluid will enter the well bore.

[In margin]: (A 1 Contd)

Under the present practice, when making such a test, it is necessary to remove the mud-laden fluid from the well bore until the hydraulic head of liquid within the well is sufficiently below the head of the cognate fluids in the formation in order to allow this latter fluid to enter the well bore. In order that this mud-laden fluid may be removed from the well bore without danger of the well caving in, it is the general practice to set a string or strings of casing in the well so that this string or strings of casing may support the walls of the well when the mud-laden fluid is withdrawn. The lower portion of at least the inside string of casing is perforated in order that the fluids from the formation may enter the casing after the removal of the mud-laden fluid. If a water sand has been encountered above the formation to be tested, it is necessary to run in a string of casing and cement or otherwise seal its bottom to the sides of the well bore at a point below the known water level, in order to protect the formation

tested from this upper water strata. This string
sing is then known as a water string. In testing a
the hole below the bottom of this water string is
protected by another string set inside the water
.

margin]: (A 1 Contd)

case the test develops that the formation tested is
ı or not commercially productive or contains water
is therefore desired to deepen the hole, it is neces-
o refill the hole with mud-laden fluid, to remove if
le the inner perforated string, and to resume drilling.
emented water string, however, must be left in the
which not only entails the cost of this string but
ses the size of the hole which can be thereafter
l. If the testing operation is repeated with the set-
of successive water strings, the size of the hole may
tely become too small for successful drilling opera-
and attempts to drill deeper must therefore be aban-
.

object of the present invention is to provide a method
pparatus for testing formations which is cheaper,
r and more effective than the methods now in use.
particularly an object of the present invention is to
le a method and apparatus for testing the formations
ated by a drill, which method and apparatus may
ployed without the necessity of removing the mud-
fluid from the well bore.

ıther object of my invention is to provide a method
pparatus for testing formations being penetrated by
, which method and apparatus does not require the
of a water string above the formation to be tested
ius permits the testing of a well without involving
st of such water string.

[Written]: (X)
87 15

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[In margin]: Per A

changes and modifications being restricted only by the scope of the following claims.

[In margin]: Here

Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States is:

87 8

-7-

10809

[In margin]: hand leaded

1. A well testing device comprising a body part having passages therethrough open at the bottom to receive a sample of the material to be tested, a packer member carried by said body part, and a bushing carried by the casing and rotatable with respect to said body part having passages therein adapted to register with the passages in

[In margin]: Per C " E

to receive the sample to be tested, said packer adapted to be positively pressed against the walls of the formation to seal off the same.

the body part ^.

2. A well testing device comprising a body part hav-g a passage therein open at its bottom to receive the aterial to be tested, a packer adjoining said body part, bushing having a passage adapted to register with the ssage in the body part and connected for manipulation the casing, and means to restrict the rotary movement

[In margin]: Insert C 1

said bushing, (3)

—

C1

3. A well testing device comprising a body part hav-g a passage extending therethrough and opening at the ds thereof, a packer associated with said body part, a n extending upwardly from said body part, a bush-g rotating on said pin and having a passage therein tending from end to end and adapted to register with e passage in said body part, said bushing having means receive a casing in communication with the passage the bushing, and means to confine said bushing on

[In margin]: Per C ~~Insert C 1~~

said passages being constructed to receive the material to be tested.

e pin, ^

—

~~C 1~~

4. A well testing device comprising a body part hav-; pins extending from the upper and lower ends there- the lower pin being of greater diameter than the per, said body part and lower pin having a continuous

87 9

passage therein open at its upper and lower ends, a packer extending about the lower pin, and a bushing mounted for rotation on the upper pin being connected to a string of casing and having a passage therein adapted to be moved into and out of registry with the passage in said body part and lower pin.

5. A well testing device comprising a body part having an upper pin, a bushing fitted to rotate about said upper pin and having a slot at its lower end with threads at its upper end to receive a casing, said pin projecting upwardly above the bushing and having means to hold the bushing on the pin, a stop member carried by said body part and projecting in the slot at the lower end of the bushing, said body part having a passage therein, said body part and bushing having passages adapted to register, and a casing carried by said body part.

6. A well testing device comprising a body part having a lower pin projecting therefrom and forming a shoulder with the body part, (said shoulder being under-cut,) a downwardly tapering packer surrounding said pin for engaging against said under-cut shoulder, and means at the lower end of said pin for constituting an abutment for said packer, said body part and pin having a passage therethrough, and means adjoining the upper end of said body part for opening and closing the communication of this passage with the casing above.

7. A well testing device comprising a body part having a pin extending from the lower part thereof,

87 10

d body part and pin having a passage therethrough, a ker extending about said pin, an adjusting sleeve on lower end of said pin, a perforated pipe secured to lower end of said sleeve, a plug in the bottom of said forated pipe, and means above the body part for regting the communication of the passage with the inior of the casing above.

[In margin]: Add ~~A 12~~ C 2

[Written]: C 2 Cls 8-17

~~A 12~~
C 2

Written]: copied

(John T. Simmons
(Full Signature of Inventor.

87 11

Serial No. 87323 Paper No. 2

[Written]: Power of Att'y

[Stamped]: MAIL ROOM MAR 16 1926 U. S. PATENT OFFICE

[Written]: 987

10786

[Stamped]: U. S. Patent Office MAR 18 1926 DIVISION 38

El Dorado, Ark. Feby. 17th 1926.

Lyon & Lyon,
National City Bk. Bldg.,
Los Angeles, Calif.
Leonard S. Lyon
Frederick S. Lyon
Henry Richmond.

I hereby authorize above named firm as well as individuals to represent me before the United States Patent Office in my Application for United States Letters Patent, Serial No. 87323 Filed Feby. 10th, 1926, Title "Well Testing Devices".

The above firm has the authority to sign its name to any and all papers in connection with the above application and are authorized to receive the Patent when granted for me.

Signed this the 17th day of February, 1926.

John T. Simmons

'ATE OF ARKANSAS)
)
)
UNTY OF UNION. . . .)

[In margin]: (R)

BE IT REMEMBERED, That on this day came before , the undersigned, a Notary Public, within and for the unty and State aforesaid duly commissioned and act- John T. Simmons, to me well known as the signor of above authority instrument, and stated that he had cuted the same for the uses, purposes, and considera- ns therein mentioned and set forth.

WITNESS, my hand and seal as such Notary Public this the 17th day of February, 1926.

Seal] Edna Cheatham
Notary Public.

Commission Expires;
. 29th 1927.

87 12

****

Another object of my invention is to provide a method and apparatus for testing formations being penetrated by a drill, which method and apparatus does not entail decreasing the size of the well bore.

Another object of my invention is to provide a method and apparatus for obtaining a sample of the cognate fluid in the formation to be tested without substantial contamination of such sample.

[In margin]: (A-1 Contd)

In accordance with my invention, whenever it is desired to test the productivity of a formation in a well, I establish an empty chamber or conduit in the well bore adjacent the formation to be tested without removing the mud-laden fluid from the well, and then permit the cognate fluids of the formation to discharge into said empty chamber or conduit. In the preferred form of the invention,

[In margin]: JK s

such empty chamber is established extending from the formation tested to the top of the well, whereby, in certain cases when the cognate fluids of the formation are under sufficient pressure, the well may commence producing through this conduit. In other cases where cognate fluids of the formation are not under such high pressure, the conduit may be again shut off from communication with the formation after certain amount of the cognate fluids of the formation have entered the empty conduit or chamber. This closing of the conduit is effected by an operator at the top of the well who can open and close the

[In margin]: Per B Cognate

nduit at will. Following the entrance of the ~~conduit~~ ^

[In margin]: JK of

id into the empty conduit ~~ot~~ chamber, the apparatus ay be ele·ated to the top of the well with the entrapped id content. The conduit being closed, the mud-laden id in the well is prevented from entering the conduit d contaminating the sample or otherwise interfering th the testing process.

87 16

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10794

The present invention also preferably embodies a means which the formation to be tested may be sealed off m the hydraulic pressure of the mud-laden fluid stand- within the well during the testing operation, and also udes a method and means by which the hydraulic ssure of the mud-laden fluid in the well may be re- osed upon the formation after the completion of the ing operation without either of these steps requiring removal of mud-laden fluid from the well bore.

In margin]: (A 1 Contd)

he present invention also provides a method and ap- tus by which a formation may be tested through the

Page 4, line 8, before "hollow" insert— inlet member 12. This inlet member 12 is indicated as preferably in the form of a—.

[In margin]: (A 4) Copied

Same page, line 9, cancel the numeral "12", both occurrences, and substitute— which, when the invention is employed to test a well through the employment of a so-called "rat hole", is adapted to fit into the "rat hole" and support the sides of said "rat hole" when the pressure

87 18

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[In margin]: Copied (A 4 contd)

of the mud-laden fluid within the well is sealed off from said hole as hereafter described—.

Same page, line 13, cancel "frusto-conical" and place a period after the numeral "15".

Same page, line 13, before "of rubber" insert—

[In margin]: (A 5) Copied

The packing member 15 is indicated as being of frusto-conical shape so that it is adapted to wedge within the upper end of the "rat hole" within the well bore and thus seal the formation below from the pressure of the mud-laden fluid within the well. For this purpose, the packer member 15 may, for example, be composed—.

Page 5, line 4, before "bushing" change "a" to—the head or—; line 5, after "19" insert—of the valve—, and after "which" insert—head—.

Same page, after line 18, insert the following paragraph:

[In margin]: (A 6)

¶ It will be seen from the foregoing description that I have provided a valve at the end of the casing 23 which can be manipulated as desired from the surface of the well to close or open the empty chamber or conduit provided by the pipe or casing 23. The slot 24 and pin 25 between the head 19 and body 4 of the valve provides a means by which the relative rotation between the head and body of the valve may be limited in order to facilitate registering the passages in the head with those in the body of the valve.—

[In margin]: (A 7) copied

Page 5, line 19, before "invention" insert—preferred apparatus of the—, and after "invention" insert—

---

and practicing the preferred method of testing formations through use of said apparatus—.

Same page, lines 19 and 20, cancel "attached to a string of casing of which 23 is a part and".

87 19

penetration of the lower end of the testing apparatus into a so-called "rat hole", or an extension of the well bore of reduced diameter, the bottom of the hole thus leaving the hole provided with a seat above the formation to be tested which may be employed for setting of water or other string of casing if the test on the well establishes the productivity of a formation.

Various further objects and advantages of the present invention will appear from a description of a preferred form or example of the present invention. For this purpose, reference is made to the accompanying drawings which illustrate an apparatus embodying the invention and which further illustrate one example of an apparatus which is suitable for use in carrying out the process embodying the present invention. —V

[Written]: (X) See original

Page 3, after line 9, insert the following paragraph:

[In margin]: Copied (A 2) See over

¶ The example of the apparatus illustrated is shown as consisting mainly of the following principal elements: A casing 23 or other means adapted to provide an empty chamber or conduit which may be lowered into a well bore and, when so lowered, provide an empty chamber adjacent the formation

87 17

[In margin]: (A 2 Contd)

o be tested. In the preferred form of the invention where this member comprises a casing 23, there will thus e provided an empty chamber or conduit extending from he formation to be tested up to the top of the well hole. The invention also comprises as the second major element valve including the valve body 4 and head or bushing 9, which is adapted to normally close such chamber or onduit 23 from communication with the mud-laden fluid ithin the well and adapted to be operated when the device as been lowered into position within the well hole to ermit the cognate fluids of the formation to discharge nto the empty chamber or conduit provided by the pipe 3. The apparatus is also illustrated as preferably comrising a packer 15 or other means for sealing off the ormation to be tested from the pressure of the head of nud-laden fluid within the well bore. The invention is lso illustrated as comprising an inlet member 12 below ne packer and valve, through which the fluids from the ormation to be tested may be permitted to discharge into ne conduit or chamber formed by the casing or pipe 23 hen the valve is operated as later described. —V

[Written]: See original

Page 3, line 10, after "drawings", insert—the body—; ne 11, change "designate" to—preferably formed of—.

[In margin]: Copied (A 3)

Page 5, line 22, change "rotate" to—close the valve by rotating—.

Page 6, before line 1, insert the following paragraph:

[In margin]: (A8)

¶ In this manner there is thus established an empty chamber or conduit adjacent the formation to be tested without the necessity of removing the mud-laden fluid from the well hole. It should be pointed out that the entrance of the mud-laden fluid into the empty chamber or conduit of the pipe or casing 23 should be prevented during the lowering of the apparatus in the well in order to prevent the pressure of the mud-laden fluid from filling up this empty chamber or conduit, whereby it would impose its hydraulic head upon the formation to be tested when the valve is opened and thus defeat the object of the testing method.—

Page 6, line 15, after "casing 24.", insert—

[In margin]: (A9)

It will be obvious that if the pressure of the cognate fluids within the formation is sufficiently high that production may then take place through the casing 23. When the pressure is not sufficient for this purpose and—

Same page, line 22, change "device" to — valve and packer —.

Same page, line 23, after "bit" insert — to the drill stem —.

Same page, same line, cancel "promptly".

Same page, after line 25, insert the following paragraph:

[In margin]: (A 10)

¶ It will be apparent that the packer 25 operates to remove the pressure of the mud-laden fluid in the well from the cognate fluids of the formation, which are then free to discharge into the empty conduit formed by the

87 20

-8-

10802

[In margin]: (A 10 Contd)

casing 23 whenever the valve is opened to permit communication between the formation and this empty conduit. It will be further seen that as soon as the valve is closed and the testing apparatus started to be removed from the formation, thus releasing the packer, the pressure of this mud-laden fluid is again immediately reimposed upon the formation, thus preventing further discharge of the fluids of such formation. In this manner the well is always under control and no danger of blowouts encountered. Moreover, the conduit being positively closed, during the withdrawal of the apparatus, the mud-

laden fluid within the well cannot contaminate the sample or otherwise interfere with the testing operation.—

Page 6, line 28, after "embodiment" insert —of the apparatus —.

Same page, last line, to and including line 2 of Page 7, cancel "such changes and modifications being restricted only by the scope of the following claims" and substi-

[In margin]: (A 11)

tute]— [and the particular embodiment of the method of the present invention is not limited nor dependent upon the use of the particular apparatus described nor is it limited to the particular details of the preferred method, but both method and apparatus of the present invention include all such changes, modifications, substitutions and equivalents as come within the scope of the following appended claims —.

[Written]: (X)

Kindly add the following new claims:

—~~8. A method of testing the productivity of a formation encountered in drilling a well which comprises~~

[In margin]: A 12

~~lowering to said formation an empty conduit closed from communication with the contents of the well, opening said conduit to permit the cognate fluids of the formation to discharge into said empty conduit, positively~~

87 21

- 9 -

~~closing the conduit, and withdrawing the conduit with its liquid to the top of the well.~~

~~9. A method of testing the productivity of a formation in a well, which comprises lowering to the formation an empty conduit, sealing off from the formation the hydraulic pressure of the fluid within the well, permitting the cognate liquids of the formation to discharge into said conduit, closing the conduit against the entrance of outside fluid, and removing the conduit with such liquids to the top of the well.~~

~~10. A method of testing the productivity of a formation in a well, which comprises establishing an empty conduit leading from the formation to the top of the well, sealing off the hydraulic head of the liquids within the well from said formation, permitting the cognate liquids within the formation to discharge into said empty conduit, reimposing the hydraulic pressure of the liquids within the well on the formation, closing the conduit against entrance of the mud laden fluid within the well and while so closed removing the conduit to the top of the well.~~

[In margin]: ~~Sub B 1~~

~~11. A method of testing the productivity of a formation in a well which comprises lowering to the formation an empty conduit, closed at its lower end and provided with a tube adapted for penetrating a "rat hole" in the formation, permitting the cognate fluids~~

~~of the formation to discharge into said empty conduit, and then removing the conduit to the top of the well.~~

[In margin]: Per B

~~12. An apparatus for testing the productivity of a formation in a well, comprising a conduit adapted to be lowered into a well to the formation, said conduit be-~~

~~an induction member~~

~~ing closed from the liquids within the well,~~ ^ ~~a tube at~~

87 22

-10-

10804

[In margin]: Per B

~~the lower end of said conduit adapted to enter a "rat~~

~~from the top of the well~~

~~hole" in the formation, and a means operative~~ ^ ~~to establish communication through said tube between the conduit and formation to permit the cognate fluids of the formation to discharge into said conduit.~~

~~13. An apparatus for testing the productivity of a formation in a well, comprising a conduit adapted to be lowered into a well to the formation, said conduit being closed from the liquids within the well, a tube~~

~~at the lower end of said conduit adapted to enter a "rat hole" in the formation, and a means operative to establish communication through said tube between the conduit and formation to permit the congnate fluids of the formation to discharge into said conduit, and means adapted to seal the formation from the hydraulic pressure of the liquids standing within the well.~~

[In margin]: Sub C 2

~~14. In an apparatus for testing the productivity of a formation encountered in a well, means adapted to be lowered in the well and provide an empty conduit from the formation to the top of the well, means carried thereby adapted to penetrate the formation, means for sealing the formation from the hydraulic pressure of the fluid standing within the well, means operative with the apparatus in the well for permitting the fluids within the formation to discharge into said empty conduit, and means operative from the top of the well for closing the conduit against entrance of fluid within the well during the ascent of the conduit.~~

~~15. In an apparatus for testing the productivity of a formation encountered in a well, means adapted to be lowered into a well and provide an empty chamber adjacent the formation to be tested, a valve adjacent the lower end~~

87 23

~~of said chamber for opening and closing said chamber, and means for operating said valve from the top of the well.~~

~~16. In an apparatus for testing the productivity of a formation encountered in a well, means adapted to be lowered into the well and provide a chamber adjacent the formation to be tested, an inlet tube adapted to extend therefrom into a hole of less size than the well bore in said formation, a valve adjacent the lower end of said chamber for opening and closing said chamber, and means for operating said valve from the top of the well.~~

[In margin]: Per B

~~15~~ ~~17.~~ ~~In an apparatus for testing the productivity of a formation encountered in a well, means adapted to be lowered into a well and provide an empty chamber adjacent the formation to be tested, means adapted to extend therefrom into a "rat hole" in said formation, packing means adapted to engage the upper part of said "rat hole", and means for opening and closing said conduit.~~

[In margin]: Sub C 2

~~16.~~ ~~18.~~ ~~In a method of testing the productivity of~~ ~~formation encountered in a well, forming a hole in~~ ~~said formation of less size than the well bore, lower-~~ ~~ing an empty conduit to said formation until its inlet~~ ~~end is in said hole, packing off the fluid within the well~~ ~~bore, permitting the fluids in said formation to enter~~

[In margin]: " B

~~conduit~~ ~~conduit~~
~~said~~ ^ ~~chamber, closing said chamber~~ ^ ~~against entrance~~
~~conduit~~
~~of fluid, and removing said chamber~~ ^ ~~from the well.~~

~~17~~ ~~19.~~ ~~In apparatus for testing the productivity of~~ ~~formations encountered in drilling, the combination of a~~ ~~casing open to the formation and extending to the sur-~~ ~~face of the ground, and a valve in the casing below~~ ~~the surface of the ground and operable from the sur-~~ ~~face to be opened and closed at will.~~

87 24

"bailers". These devices are not intended to make a test of the formations of a well while leaving the mud fluid within the well but are devised and employed for the purpose of removing the mud-laden fluid itself from the well. It is believed that the Examiner will readily see that none of the present claims reads on these references.

The main reference relied upon by the Examiner is the patent to Steele. This patent does not lower an empty conduit to a formation in a well but lowers a conduit to the formation and then excludes liquid therefrom by blowing air down the conduit. No test can be made by the device of the Steele patent unless the pressure upon the fluids in the formation is sufficiently high to force said fluids to the top of the well, inasmuch as there is no means shown for entrapping fluids within the conduit and elevating the same to the top of the well. For example, in claim 13, the element of a conduit closed from the liquids within the well is not present, since the conduit of the Steele device is entirely open to the fluids within the well during the ascending and descending operations. Moreover, the inlet member of the Steele device is not intended to be positioned in a "rat hole" or hole of reduced size at the bottom of the well and is shown of such a size that it could not successfully be lowered into such a "rat hole". Claim 13 thus distinguishes from the references in this particular.

Claims 1 to 3 are clearly not anticipated by the Steele reference for the reason that they call for a rotatable bushing having a passage adapted to register with a passage in the body of the device. While the parts of the Steele device may be rotative during the assembly process, they do not so operate at any time after assembly, nor would any such relative rotation accomplish any useful function in the Steele apparatus, and it is not

believed that the reference is proper anticipation of the claims.

The attention of the Examiner is directed to patents with which applicant is familiar, namely, those to Cox,

—

No. 1,347,534, issued July 27, 1920, and Edwards, No. 1,514,585, issued November 4, 1924. These patents are mentioned in order to facilitate the prosecution of the application by explaining to the Examiner wherein these references are not anticipations of any of the claims now presented.

The Cox patent discloses a device which is intended to be lowered into a well containing a packer at its lower end for shutting off the formation from the mud fluid within the well and providing an empty conduit which will then lead from the formation to the top of a well. The lower end of said conduit is closed by a fragile member which is intended to be broken when the device lands at the bottom of the well and permit entrance of the test fluid into the conduit. This device has never been successfully used and cannot be successfully used in the testing of formations in a well. In this connection, it is pointed out to the Examiner that with a well of, for example, 4,000 feet in depth, the hydraulic pressure at the bottom of the well will be in the neighborhood of about 2,000 pounds per square inch. This pressure is so great that no fragile device supported by a flexible or rubber packer could be successfully used, as such fragile device would be crushed under the pressure or

~~relative rotation between said anchor means and said conduit.~~

~~22. An apparatus for testing the productivity of formations encountered in a well comprising a conduit adapted to be lowered through the mud fluid in said well to said formation, means swivelly carried by said conduit including a tapered packer adapted to be wedged in the upper end of a rat hole in the well and thus anchored in fixed rotary position, and a valve in said~~

87 32

~~conduit adapted to be operated by relative rotation between said anchor means and said conduit.~~

REMARKS

In preparing the above amendments, care has been taken not only to present claims which are believed allowable over the references of record, but to present claims which are believed allowable in view of an independent search made as to the novelty of the present invention.

As explained in the specification, the invention of the present application is one of very considerable importance

the oil well drilling art. The apparatus and method the present invention have been placed in practical where it has been successful in determining the stence or absence of oils, gas, or water in formans encountered in a well where there was no indican of the presence of such fluids from the top of the l. The present process and apparatus has been sucsfully used even for the purpose of determining subntially the rate of flow of oil from the well which can expected.

Both the art cited by the Examiner and that unered by the independent search, disclose that for some e the importance of being able to make a test in the nner of the present invention has been recognized , as hereinafter pointed out, no one of the apparatuses processes previously devised can be successfully emyed for testing formations in a well, and it can be ven by affidavits, if the Examiner so desires, that apparatuses and methods of the testing devices relied on by the Examiner have not been placed in commer- use.

Of the patents cited by the Examiner, those to Boynton l Candee are not believed proper references, since they not relate to testing devices but are what are known the art as

87 33

Div. 38 Room 145 RAB/fbk Paper No. 2 rej. 4
Address only

"The Commissioner of Patents,
Washington, D. C."
and not any official by name

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

All communications respecting this application should give the serial number, date of filing, and name of the applicant

June 11, 1926.

Please find below a communication from the EXAMINER in charge of this application

Thomas E. Robertson
Commissioner of Patents

[Stamped]: MAILED JUN 11 1926

Lyon & Lyon
National City Bank Building,
Los Angeles, California.

Applicant: John T. Simmons
Ser. No. 87,323
Filed Feb. 10, 1926
For Method and Apparatus for Testing the Productivity of Formations Encountered in Wells

This application has been examined.

References made of record:

McGregor	582,828	May 18, 1897	166/19
Candee	1,505,624	Aug. 19, 1924	166/19
Boynton	1,508,771	Sep. 16, 1924	166/19
Steele	1,547,240	Jul. 28, 1925	166/21

Claims 1 to 3 inclusive are rejected on Steele, cited. The means which restrict the rotary movement of the bushing 4 in the Steele device, are, of course, the threads and shoulders.

Claims 4 to 7 inclusive are allowed.

Claims 8 to 11 inclusive are rejected as being improper method claims, in that they merely set forth the functions of applicant's device.

Claim 12 is rejected on Mc Gregor, cited.

Claim 13 is rejected on Steele, cited.

Claim 14 is allowed.

Claims 15 and 16 are rejected on Boynton or Candee.

Claim 17 is allowed.

Claim 18 is indefinite "said chamber" has no antecedent.

Claim 19 is rejected on Boynton.

Claim 20 appears allowable.

[In margin]: B

C. F. Krafft,
Acting Examiner.

107. 87 27

[Stamped]: U. S. Patent Office DEC 29 1926 DIVISION 38.

[Stamped in Margin]: MAIL ROOM DEC 28 1926 U. S. PATENT OFFICE

Serial No. 87,323 Paper No. 7

Amendment B

IN THE UNITED STATES PATENT OFFICE

John T. Simmons,	:	
METHOD AND APPARATUS FOR TESTING THE PRODUCTIVITY OF FORMATIONS ENCOUNTERED IN WELLS,	:	Division 38 - Room 145.
Filed February 10, 1926,	:	
Serial No. 87,323.	:	

Los Angeles, California,
December 21, 1926.

Honorable Commissioner of Patents,
Washington, D. C.

Sir:

In response to the Office letter of June 11, 1926, kindly amend as follows:

In the amendment to the specification of March 9, 1926, page 4, line 28, change "conduit" to -cognate-.

Rewrite claims 8 to 11 and follows:

[In margin]: B 1

8. ~~A method of testing the productivity of a formation encountered in a well, which includes lowering an empty conduit to said formation, packing off the formation from the fluid within the well bore, permitting the fluids in said formation to enter said conduit, closing said conduit against the entrance of fluid from the well, and removing said conduit with an entrapped sample of the cognate fluids of the formation from the well.~~

9. ~~A method of testing the productivity of a formation encountered in a well having a mud-laden fluid therein, which includes lowering an empty conduit to said formation through said mud-laden fluid, packing off the mud-laden fluid within the well bore from said formation, permitting the fluids~~

87 30

~~in said formation to enter said conduit,~~ ^ ~~and maintaining the mud fluid of the well substantially quiescent during the flow of fluids from said formation into said conduit.~~

~~10.~~ ~~A method of testing the productivity of a formation in a well which comprises lowering an empty conduit to said formation through the mud fluid of the well, packing off the mud fluid within the well bore from said formation, permiting the cognate fluids within the formation to discharge into said empty conduit, reimposing the hydraulic pressure of the liquids of the mud fluid within the well on said formation, closing said conduit against entrance of said mud fluid, and removing said conduit with the entrapped quantity of cognate fluid of the formation from the well.~~

[In margin]: Per C Sub C 2

~~11.~~ ~~A method of testing the productivity of a formation in a well, which comprises forming a hole in said formation of less size than the well bore, lowering an empty conduit to said formation through the mud fluid of the well until its inlet line is in said hole, packing off the mud fluid within the well from said formation, and permitting the cognate fluids of the formation to enter said conduit.~~

---

a an

√ Claim 12, line 4, change "^tube" to –^induction member–. Line 6, after "operative" insert –from the top of the well–.

√ Cancel claims 15 and 16.

√ Claim 18, line 7, both occurrences, change "chamber" to –conduit–. Line 8, change "chamber" to –conduit.–.

√ Renumber the claims.

√ Add the following claims:

[In margin]: B 2 Sub C 2

~~19. In an apparatus for testing the productivity of a formation encountered in a well, means adapted to be lowered into the well and provide an empty chamber adjacent the formation to be tested while leaving mud fluid within the well, an inlet tube adapted to extend therefrom into a hole of less size than the well bore in said formation, a tapered packer adapted to engage the top of said hole and seal the formation from the mud fluid within the remaining hole, a valve adjacent the lower end of said chamber for opening and closing said chamber, and means for operating said valve from the top of the well.~~

~~20. An apparatus for testing the productivity of a formation encountered in drilling a well which comprises a conduit adapted to extend from the formation to the top of the well while the mud-laden fluid is within the well for establishing an empty conduit for test fluid, a packer swivelly connected to said conduit, and a valve for said conduit adapted to be operated from open to closed position by relative motion between said packer and conduit.~~

~~21. An apparatus for testing a formation encountered in a well comprising a conduit adapted to be lowered into a well, means carried by said conduit adapted to be anchored in a fixed rotary position in the well and a valve for said conduit adapted to be operated by~~

~~18~~ ~~20.~~ ~~In apparatus for testing the productivity of formations encountered in drilling, the combination of a casing open to the formations and extending to the surface, a valve in the casing near its bottom and operable from the surface of the ground, and a packer near the bottom of the casing.~~

[In margin]: Insert B 2

REMARKS

A study of the invention demonstrates that the inventor has devised not only a new apparatus but apparently a new method of testing the productivity of formations in a well, and therefore the specification and claims have been amended in order to cause the claims to cover more nearly all of the invention. It will be apparent that no change has been made either in the description of the device or of the method, as both the device and the method were clearly originally disclosed, and that the amendments to the specification are mainly for the purpose of more clearly pointing out the broad scope of the invention and the results to be accomplished thereby and for the purpose of forming certain broader terminology to be employed in the apparatus and method claims.

Respectfully submitted,

Lyon & Lyon
Attorneys for Applicant.

RFL MK

SUUPLEMENTAL OATH

STATE OF Oklahoma)
)
COUNTY OF Stephens)

[Stamped in margin]: APPLICATION DIV. MAR 24 1926 U. S. PATENT OFFICE

JOHN T. SIMMONS, whose application for letters patent for an improvement in WELL TESTING DEVICES, Serial No. 87323, was filed in the United States Patent Office on or about the 10th day of February, 1926, being duly sworn, deposes and says that the subject matter of the foregoing amendment was part of his invention, was invented before he filed his original application, above identified, for such invention, was not known or used before his invention, was not patented or described in a printed publication in any country more than two years before his application, was not patented in a foreign country on an application filed by himself or his legal representatives or assigns more than twelve months before his application, was not in public use or on sale in this country for more than two years before the date of his application, and has not been abandoned.

John T. Simmons

Sworn to and subscribed before me this 15 day of March, 1926.

[Seal] A L Dempsey

Notary Public in and for the County of Stephens

State of Oklahoma

My Commission Expires November 12, 1929

87 26

[Written]: # 5.
[Written]: DOC

[Stamped]: MAIL ROOM JUN 14 1926 U. S. PATENT OFFICE

[Stamped in margin]: DOCKET DIVISION JUN 14 1926 U. S. PATENT OFFICE

POWER OF ATTORNEY

To the Commissioner of Patents:

I, JOHN T. SIMMONS of Eldorado, Arkansas, having invented certain new and useful improvements in WELL TESTING DEVICES, for which I have filed application for Letters Patent of the United States, Serial No. 87,323, filed February 10, 1926, do hereby appoint the firm of Lyon & Lyon, (the individual members of which firm are Frederick S. Lyon and Leonard S. Lyon) of 708 National City Bank Building, Los Angeles, California, my attorneys in the matter of the said application, with full power of substitution and revocation, to sign the drawings, make amendments and alterations in said application, to receive the patent and to transact all business in the United States Patent Office in connection therewith; hereby revoking any and all Powers of attorney heretofore given by me in the matter of the said application.

Dated May 24th, 1926.

John T. Simmons

I hereby ratify and confirm the above Power of Attorney and revocation.

Erle P. Halliburton
Assignee

[Stamped]: JUN 15 1926
T. E. Robertson
Commissioner

87 28

EEG #6

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

June 17, 1926.

Lyon and Lyon
708 National City Bank Bldg.,
Los Angeles, Calif.

Applicant John T. Simmons
Serial No. 87,323
Filed............Feb. 10, 1926
For........Method and Apparatus for Testing the Productivity of Formations Encountered in Wells.

In this case your power of attorney has been accepted.

Respectfully
Thomas E. Robertson
Commissioner.

11—8898

Revoking power of attorney
to
Wilkinson and Giusta,
Ouray Bldg.,
Washington, D. C.

87 29

the flexible device collapsed and the fragile element lost out of the device. Moreover, the device of the Cox reference employs as the conduit for the test fluid, a flexible hose 13 which is subjected to the hydraulic pressure of the mud-laden fluid within the well through the ports 4. Such a rubber hose would unquestionably collapse under such pressure, entirely preventing any successful testing. Moreover, when the testing device of the Cox patent is reaised from the bottom of the well, there is nothing to prevent the mud

87 35

fluid of the well from entering the conduit through the perforations 8 by the clapper valve 15, intermingling the test fluid to such an extent as to spoil entirely the testing operation. The attention of the Examiner is drawn to the fact that the patentee Cox provided a clapper valve 15 with the idea of preventing the fluids within the hose 13 from dropping out of the testing device, forgetting that the mud-laden fluid surrounding the testing device would be under a much higher pressure and that what is necessary is a device to prevent

nud-laden fluid entering and commingling with the
pped test fluid.

e Cox patent is an enlargement upon the McGregor
t, relied upon by the Examiner in rejecting claim
nd it is believed that claim 12 is allowable over the
ence McGregor for the reasons explained in the dis-
on of the Cox reference. The McGregor device is
usly not adapted to provide an empty conduit at
bottom of a well hole, and does not disclose any
s by which the passage of fluid into the said conduit
l be successfully controlled from the top of the

nother important distinction between the Cox refer-
and applicant's device is that during the purported
g operations of the Cox device, mud-laden fluid is
nuously passed down through the casing 1 of the
device and out the ducts 4 for the purpose of cir-
ing the mud-laden fluid within the well. The pur-
of the patentee of this circulation was to provide a
s for preventing the mud-laden fluid from settling
the testing device and freezing the same in the well
Applicant has discovered, however, that this cir-
ion is the means of defeating the very object which
as designed to accomplish. When the lower end
e testing device is packed to the formation any cir-
ion of the mud-laden

87 36

fluid thereabove merely tends to wash down upon the packer of the testing device material from the well hole, freezing the same in place. The Examiner will, therefore, find several of the newly submitted claims carrying limitations to the effect that the mud-laden fluid is maintained quiescent during the testing operations.

The patent to Edwards discloses a testing device similar

—

to Cox, in that the patentee intended to circulate the mud-laden fluid during the testing operation. This patent differs from Cox in that it has a conduit which can be opened and closed from the top of the well but for this purpose, the patentee requires two separate strings of casing telescoped one within the other, and a means for independently moving these casings. Moreover, the device of the reference does not disclose an apparatus which can be successfully utilized for packing off the mud-laden fluid of the well from the formation to be tested. The packer of the Edwards device is intended to

———

be operated by bowed springs. These bowed springs necessarily have to come into contact with the loose earth and formation at the bottom of the well, which is not capable of applying to the springs any very substantial resistance. It is, therefore, impossible that the springs of the Edwards patent can apply to the packer 5 sufficient force to maintain the same packed against the walls of the well, against the tremendous hydraulic pressure of the mud-laden fluid at the bottom of a well.

Claims 8 to 11 inclusive have been rewritten to overcome the objection to the claims that they were in improper method form. The new claims are believed to be largely self-explanatory in view of the preceding careful discussion of the references cited and the advantages of applicant's device over such references. It will be found that each one of the newly

added claims distinguish from the references, and it is believed that they are clearly allowable, and such allowance is requested.

Respectfully submitted,

Lyon & Lyon
Attorneys for Applicant.

RFL:LR

Serial No. 87,323 Paper No. 9

Amendment C

[Stamped]: U. S. Patent Office JUN 17 1927 DIVISION 38

[In margin]: APPLICATION DIV. JUN 17 1927 U. S. PATENT OFFICE

10812

IN THE UNITED STATES PATENT OFFICE

John T. Simmons,	:	
METHOD AND APPARATUS FOR TESTING THE PRODUCTIVITY OF FORMATIONS ENCOUNTERED IN WELLS	:	Division 38, Room 145
Filed February 10, 1926,	:	
Serial No. 87,323	:	

Washington, D. C.
June 17, 1927.

Honorable Commissioner of Patents,
Washington, D. C.

Sir:

In response to Office letter of May 20, 1927, please amend as follows:

√ Claim 1, line 7, cancel the period and add —to receive the sample to be tested.—

√ Claim 2, line 7, and claim 3, line 9, change the period to a comma and add / –√–said passages being

[In margin]: (C1) per E.

, said packer adapted to be positively pressed against the walls of the formation to seal off the same

constructed to receive the material to be tested^

√ Cancel claims 8-22 and add the following claims:

[In margin]: C2

~~23. A method of testing the productivity of a formation encountered in a well containing drilling fluid, which includes lowering a sample chamber into the well through the drilling fluid to the formation to be tested, the chamber being closed against the entrance of fluid from the well during the lowering operation, sealing off the well above the formation to exclude the drilling fluid from the formation, opening the chamber to permit cognate fluid from the formation to enter the chamber, closing the chamber against the entrance of~~

[In margin]: Per D.

~~fluid from the well, releasing the seal X and removing the chamber so closed to withdraw an entrapped sample of fluid from below the point at which the well was sealed off.~~

E 1

[In margin]: Insert E 1 (here)

12. . ~~29~~. Apparatus for testing a formation encountered in a well containing drilling fluid, which includes a single string of pipe to be lowered into the well to adjacent the formation to be tested, a valved inlet at the lower end of the pipe, positively controlled from the top of the well by movement of the pipe and a packer carried by the pipe above the inlet, said packer being

[In margin]: per E.

adapted to be positively pressed against the walls of the formation to seal off the same.

87 42

-3-

10815

13. ~~30~~.. Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, which includes an empty string of pipe to be lowered into the well to adjacent the formation to be tested, a

[In margin]: per E.

adapted to be positively pressed against the walls of the formation to seal off the same

packer carried by the pipe ^ , means at the lower end of the pipe to receive a sample from the formation including an inlet opening into the pipe and a valve structure for controlling the inlet, the valve structure including a plurality of relatively movable parts one of which is secured to the pipe and another of which is connected to the packer.

[In margin]: (C 2 Contd)

14. ~~31~~. Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, which includes a single empty string of pipe to be lowered into the well to adjacent the formation to be tested, means lowered into the well by said string of pipe for sealing off the drilling fluid from the forma-

[In margin]: Per E. JK

, said sealing means being adapted to be positively pressed against the walls of the formation to seal off the same

tion to be tested ^ , means at the lower end of said string of pipe to receive a sample from the formation including an inlet opening into said pipe and a valve structure for controlling the inlet, said valve structure including a part connected to said sealing means and a part connected to said pipe.

15. ~~32~~. Apparatus for testing the productivity of a formation encountered ~~in~~ a well containing drilling fluid, comprising a single empty string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to be tested, a packer lowered into the well by said string of pipe for sealing off the drilling

[In margin]: Per E.

, said packer adapted to be positively pressed against the walls of the formation to seal off the same

fluid from the formation to be tested ^ , means at the lower end of said string of pipe to receive fluid from said formation including an inlet opening into said pipe below said packer and a valve structure for

87 43

[In margin]: (C2)

8, ~~24~~. A method of testing the productivity of a formation encountered in a well containing drilling fluid, which includes lowering an empty string of pipe into the well through the drilling fluid to adjacent the formation, the pipe carrying a packer and having a valved inlet at its lower end which is closed while the pipe is being lowered, setting the packer above the formation to seal off the drilling fluid from the formation, opening the valved inlet after the packer is set to permit cognate fluid from the formation to enter the pipe, closing the valved inlet against the entrance of fluid from the well by movement of the pipe. raising the pipe so closed to remove an entrapped sample and the packer from the well.

[Written]: (X)

~~25. A method of testing the productivity of a formation encountered in a well containing drilling fluid involving the insertion of only a single string of pipe into the well to make a test, which includes lowering a test string into the well through the drilling fluid with a packer carried by the string and a valved inlet at the lower end of the string closed against the entrance of fluid from the well, setting the packer above the formation and opening the valve to permit cognate fluid from the formation to enter the inlet, closing the valve to prevent the subsequent entrance of fluid from the well through the inlet and releasing the packer, and raising the test string with the inlet closed against the entrance of fluid from the well to remove an entrapped,~~

[In margin]: D.

~~sample (and the packer.)~~

9. ~~26~~. Apparatus for testing a well comprising a string of pipe to be lowered into a well having an in-

[In margin]: per E.

packer adapted to be positively pressed against the walls of the formation to seal off the same

let at its lower end and carrying a ^ ~~packing for sealing the well~~ above the inlet, and a valve for the inlet positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

10. ~~27~~. Apparatus for testing a well comprising a string of pipe to be lowered into the well, a packer car-

[In margin]: per E.

said packer adapted to be positively pressed against the walls of the formation to seal off the same

ried by the pipe ^ and means at the lower end of the pipe to receive a sample from the well including an inlet and a valve for controlling the inlet, the valve being positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

[In margin]: (C 2 Contd)

11. ~~28~~. Apparatus for testing a well containing drilling fluid, which includes an empty string of pipe to be lowered in the well to adjacent the formation to be tested, means at the lower end of the pipe to receive a sample from the formation including an inlet opening into the pipe and a valve for controlling the inlet, and means carried by the pipe for sealing the well above the

(2)

inlet ^ , the valve being positively controlled by movement of the pipe.

controlling the inlet, said valve structure having a relatively stationary part connected to the packer and a relatively movable part connected to the pipe.

[In margin]: (C 2 contd)

16. ~~33.~~ Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, comprising a single empty string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to be tested, a packer carried by the pipe for sealing off the well above the formation an inlet below

[In margin]: Per E. JK

, said packer adapted to be positively pressed against the walls of the formation to seal off the same

the packer opening into the pipe ^, and a valve for the inlet, the setting of the packer and the operation of the valve being positively controlled by movement of the pipe.

~~34. Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid. comprising a string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to be tested, means carried by the string of pipe to permit the flow of cognate fluid from the formation into the pipe said means including relatively movable parts having passages adapted to be brought into alignment to allow the fluid to flow into the pipe and brought out of alignment to retain the fluid in the pipe, and a packer~~

~~mounted on one of said parts for sealing off the drilling fluid from the formation while the passages are aligned.~~

[In margin]: Per D.

~~35. Apparatus for testing the productivity of a formation in a well containing drilling fluid, comprising a string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to receive a fluid sample therefrom and to be raised out of the well to remove~~

87 44

~~the entrapped sample, said pipe being closed against the flow of drilling fluid as the pipe is lowered into the well, a packer carried by the pipe as the pipe is lowered into (and removed from) the well and adapted to be seated by manipulation of the pipe to seal off the well above the formation, an inlet to the pipe communicating with the well below the point at which the packer seals off the well, and means for controlling the inlet to permit fluid from the formation to enter the pipe while the packer is set and to prevent fluid from entering the pipe after the packer is released and the pipe is being raised out of the well~~

[In margin]: Per D.

RAB/hm

Div. 38 Room 145 Paper No. 8–Rej.

Address only

"The Commissioner of Patents,
Washington, D. C.,"

and not any official by name

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

All communications respecting this application should give the serial number, date of filing, and name of the applicant

May 20, 1927

Please find below a communication from the EXAMINER in charge of this application.

Thomas E. Robertson
Commissioner of Patents.

Applicant: John T. Simmons
Ser. No. 87323
Filed Feb. 10, 1926
For Method and Apparatus for testing the Productivity of Formations Encountered in Wells

[Stamped]: PATENT OFFICE MAY 20 1927 MAILED

Lyon & Lyon,
708 Natl. City Bank Bldg.
Los Angeles, Calif.

Amended December 28, 1926.

Claims 1-3 are again rejected on *Steel* of record. The claims are readable on the Steele disclosure and must define a patentable difference.

Claims 4 to 7 inclusive stand allowed.

The remaining claims are rejected on the patent to Edwards, made of record by applicant. Claim 13 is further and again rejected on Steele. The Steele device is adapted to fit a rat hole of suitable size.

Many of the claims are readable on the Cox patent. made of record by applicant.

[In margin]: B.

C. F. Krafft
Examiner.

107 87 39

THIS ACTION MUST BE RESPONDED TO
WITHIN SIX MONTHS.

[In margin]: (C 2 contd)

17. ~~36.~~ Apparatus for testing a well containing drilling fluid, comprising a single string of pipe to be lowered into the well through the drilling fluid, said pipe being closed against the entrance of the drilling fluid, means at the lower end of the pipe for receiving a sample including an inlet opening into the pipe, means carried by the pipe for sealing the well above the in-

[In margin]: JK E

, said sealing means adapted to be positively pressed against the walls of the formation to seal off the same

let ∧ , and a valve for the inlet that may be positively opened and closed by movement of the pipe while the well is sealed above the inlet.

[In margin]: dd .)1 1s 18 & 19

REMARKS.

New claims have been substituted for the rejected claims pursuant to an interview with the Examiner. This has been done to facilitate the consideration of the case and to place the claims in better form. It is not admitted by applicant that the references disclose the invention or meet the rejected claims.

87 45

Edwards discloses an arrangement in which it is necessary to lower two strings of pipe into the well to make a test: A a drill stem carrying a packer and B a sample string. Edwards does not recover an entrapped sample and could not according to his disclosure for he teaches to withdraw the apparatus when the packer is first released and the test stem is then withdrawn before withdrawing the drill pipe and packer. Edwards directs that the packer be released before stopping the slush pump which necessarily involves the passage of drilling fluid into the sample string. The mode of operation embodied in applicant's invention and the arrangement of parts embraced in applicant's invention are entirely different and superior to Edwards.

Cox provides a frangible closure to keep the test tube free of drilling fluid while his structure is being lowered into the hole but after this frangible element is once broken Cox provides no means for closing his test tube against the entrance of fluid from the well. The check valve 15 illustrated by Cox does not function to close the test tube from the entrance of fluid and upon the release of the packer the superior pressure of the mud laden fluid would result in the passage of fluid into the sample string. Both Cox and Edwards insert two conduits into the well for the purpose of taking a test and have each employed the outer conduit for the purpose of circulating drilling fluid during the test operation. Applicant's teaches the use of a single test string carrying the valve structure and the packer and his invention represents

87 46

the difference between an established success and an established abandoned failure. Claims 1 to 3 have been amended to provide that the passages which are rotated into alignment are to receive the material to be tested which is not true of *Steel.* All of the claims are now understood to be allowable and an early action is requested.

Respectfully submitted,

Lyon & Lyon
Attorneys for Applicant.

87 47

Div. 38 Room 145 Paper No. 11

Address only

"The Commissioner of Patents,
Washington, D. C.,"

and not any official by name

RAB/B

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

All communications respecting this application should give the serial number, date of filing, and name of the applicant

[Stamped]: PATENT OFFICE JUL 13 1927
MAILED

July 13, 1927

Please find below a communication from the EXAMINER in charge of this application.

Thomas E. Robertson
Commissioner of Patents

[Stamped]: APPLICATION DIV. JUN 22 1927 U
S. PATENT OFFICE

7 Bry

Patent No. 87,323 Paper No. 10
Asso. Power of Atty.

Div. No. 38 Room No. 1-

ASSOCIATE POWER OF ATTORNEY.

Applicant John T. Simmons

Improvement in Method and Apparatus for Testing t
Productivity of Formations Encountered in We

Filed Feb. 10, 1926
Serial No. 87,323

Phone Main 37

In the U. S. Patent Office.

Hon. Commissioner of Patents:

Sir:

Please recognize J. M. MASON, McGill Buildi
Washington, D. C., Registry No. 11532, as....our....as
ciate in the above-entitled application, and address
communications to him.

Lyon & Lyon
Attorney of Record

87 48

Applicant: John T. Simmons
Ser. No. 87323
Filed Feb. 10, 1926

For Method and Apparatus for
Testing the Productivity of
Formations Encountered on Wells.

J. M. Mason,
McGill Building,
Washington, D. C.

Applicant's claims appear to be allowable.

Further action in this case will await consideration of a possible interference proceeding.

G. D. G. Nicolson,
Acting Examiner

[Written]: B.

107 87 -49

THIS ACTION MUST BE RESPONDED TO
WITHIN SIX MONTHS.

(Drawing)

[For copy of this drawing accompanying patent 1,930,-987, filed Feb. 10, 1926, see Plaintiffs' Exhibit 1 heretofore set forth.]

Bryant:MEB

Div. 38 Room 145 Paper No. 12

Address only
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Washington, D. C.,"
and not any official by name

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

All communications respecting this application should give the serial number date of filing, and name of the applicant

[Written]: Copy sent Assignee

[Written]: A

[Stamped]: PATENT OFFICE OCT 10 1927 MAILED.

Please find below a communication from the EXAMINER in charge of this application

Thomas E. Robertson
Commissioner of Patents

[Stamped]: OCT 5 - 1927

Applicant: John T. Simmons,
Ser. No. 87,323
Filed Feb. 10, 1926,
For Method and Apparatus
for Testing the Productivity
of Formations Encountered in
Wells.

J. M. Mason,
McGill Bldg.,
Washington, D. C.

The case, above referred to, is forwarded to the Examiner of Interferences because it is adjudged to interefere with others, hereafter specified. The question of priority will be determined in conformity with the Rules. The interference will be identified as No. 55940 On or before NOV 14 1927 the statement demanded by rule 110 must be sealed up and filed with the subject of invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

[Written]: p 24-25

Count 1.

A method of testing the productivity of a formation in a well containing drilling fluid, which includes lowering a sample chamber into the well through the drilling fluid to the formation to be tested, the chamber being closed against the entrance of fluid from the well during the lowering operation, sealing off the well above the formation to exclude the drilling fluid from the formation, opening the chamber to permit cognate fluid from the formation to enter the chamber, closing the chamber

against the entrance of fluid from the well, releasing the seal and removing the chamber so closed to withdraw an entrapped sample of fluid from below the point at which the well was sealed off.

Count 2.

A method of testing the productivity of a formation encountered in a well containing drilling fluid, which includes lowering an empty string of pipe into the well through the drilling fluid to adjacent the formation, the pipe carrying a packer and having a valved inlet at its lower end which is closed while the pipe is being lowered, setting the packer above the formation to seal off the drilling fluid from the formation, opening the valved inlet after the packer is set to permit cognate fluid from the formation to enter the pipe, closing the valved inlet against the entrance of fluid from the well by movement of the pipe, raising the pipe so closed to remove an entrapped sample and the packer from the well.

[Written]: 8

Count 3.

A method of testing the productivity of a formation encountered in a well containing drilling fluid involving the insertion of only a single string of pipe into the well to make a test, which includes

[Written]: p 25

87—50

lowering a test string into the well through the drilling fluid with a packer carried by the string and a valved inlet at the lower end of the string closed against the entrance of fluid from the well, setting the packer above the formation and opening the valve to permit cognate fluid from the formation to enter the inlet, closing the valve to prevent the subsequent entrance of fluid from the well through the inlet and releasing the packer, and raising the test string with the inlet closed against the entrance of fluid from the well to remove an entrapped sample and the packer.

Count 4.

[In margin]: √

Apparatus for testing a well comprising a string of pipe to be lowered into a well having an inlet at its lower end and carrying √ for sealing the well above the inlet, and a valve for the inlet positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

Count 5.

[In margin]: √

Apparatus for testing a well comprising a string of pipe to be lowered into the well, a packer carried by the pipe and means at the lower end of the pipe to receive a sample from the well including an inlet and a valve for controlling the inlet, the valve being positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

Count 6.

[In margin]: √

Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, which

includes an empty string of pipe to be lowered into the well to adjacent the formation to be tested, a packer carried by the pipe, means at the lower end of the pipe to receive a sample from the formation including an inlet opening into the pipe and a valve structure for controlling the inlet, the valve structure including a plurality of relatively movable parts one of which is secured to the pipe and another of which is connected to the packer.

Count 7.

[In margin]: √

Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, which includes a single empty string of pipe to be lowered into the well to adjacent the formation to be tested, means lowered into the well by said string of pipe for sealing off the drilling fluid from the formation to be tested, means at the lower end of said string of pipe to receive a sample from the formation including an inlet opening into said pipe and a valve structure for controlling the inlet, said valve structure including a part connected to said sealing means and a part connected to said pipe.

Count 8.

Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, comprising a single empty string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to be tested, a packer lowered into the well by said string of pipe for sealing off the drilling fluid from the formation to be tested, means at the lower end of said string of pipe to receive fluid from said formation including an inlet opening into

87 51

said pipe below said packer and a valve structure for controlling the inlet, said valve structure having a relatively stationary part connected to the packer and a relatively movable part connected to the pipe.

Count 9.

Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, comprising a single, empty string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to be tested, a packer carried by the pipe for sealing off the well above the formation, an inlet below the packer opening into the pipe, and a valve for the inlet, the setting of the packer and the operation of the valve being positively controlled by movement of the pipe.

Count 10.

Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, comprising a string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to be tested, means carried by the string of pipe to permit the flow of cognate fluid from the formation into the pipe, said means including relatively movable parts having passages adapted to be brought into alignment to allow the fluid to flow into the pipe and brought out of alignment to retain the fluid in the pipe, and a packer mounted on one of said parts for sealing off the drilling fluid from the formation while the passages are aligned.

Count 11.

Apparatus for testing the productivity of a formation in a well containing drilling fluid, comprising a string

of pipe to be lowered into the well through the drilling fluid to adjacent the formation to receive a fluid sample therefrom and to be raised out of the well to remove the entrapped sample, said pipe being closed against the flow of drilling fluid as the pipe is lowered into the well, a packer carried by the pipe as the pipe is lowered into and removed from the well and adapted to be seated by manipulation of the pipe to seal off the well above the formation, an inlet to the pipe communicating with the well below the point at which the packer seals off the well, and means for controlling the inlet to permit fluid from the formation to enter the pipe while the packer is set and to prevent fluid from entering the pipe after the packer is released and the pipe is being raised out of the well.

Count 12.

Apparatus for testing a well containing drilling fluid, comprising a single string of pipe to be lowered into the well through the drilling fluid, said pipe being closed against the entrance of the drilling fluid, means at the lower end of the pipe for receiving a sample including an inlet opening into the pipe, means carried by the pipe for sealing the well above the inlet, and a valve for the inlet that may be positively opened and closed by movement of the pipe while the well is sealed above the inlet.

The interference involves your application, above identified.

[Written]: 87 52

an application for "Apparatus for Testing Wells" filed by Charles L. Williams, whose post office address is 969 B Union Trust Bldg., Pittsburgh, Pa; whose attorney is Archworth Martin, 513 Union Trust Bldg., Pittsburgh,

—

Pa.; an application for "Well Tester" filed by Otto J. Allen whose Post office address is 409 Sames-Moore Bldg., Laredo, Webb County, Texas, whose attorney is Hardway & Cathey, 428 Bankers Mortgage Bldg., Houston, Texas; an application for "Well Testing Tools" filed by Conrad T. Neitzel, whose post office address is 2236 Live Oak St., Dallas, Texas; whose attorney is Jack A. Schley, 904 Allen Bldg., Dallas, Texas; whose associate attorney is Alfred T. Gage, 3915 Legation St., Washington, D. C.; an application for "Well Tester" filed by Ernest Powell whose post-office address is Box 56A, Route 1, Von Orme, Texas; whose attorney is Jesse R. Stone, C/o Andrews,

—

Streetman, Logue & Mobley, Union National Bank Bldg., Houston, Texas; an application for "Well Testing Device" filed by Guy V. Lewis, whose post office address is Robert E. Lee Hotel, Laredo, Texas; whose attorney is Jesse R. Stone, Andrews, Streetman, Logue & Mobley, Union National Bank Bldg., Houston, Texas; an application for "Oil Well Packers" filed by David Erickson, whose post office address is Erickson Pattern Works, 508 Ohio Ave., Wichita Falls, Texas; whose attorney is Watson, Coit, Morse and Grindle, Mather Bldg., Washington, D. C.; an application for "Well Formation Testing Device" filed by Edgar Clinton Johnston, whose post office address is El Dorado, Union County, Arkansas; whose attorney is Clarence A. O'Brien Security Savings

& Commercial Bank Bldg., Washington, D. C.; whose assignee is Johnston Formation Testing Corporation of El Dorado, Arkansas; and an application for "Oil Well Testing Device" filed by Ernest H. Cox, whose post office address is Duncan, Stephens County, Oklahoma, and whose attorney is Eccleston & Eccleston of Loan & Trust

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Bldg.,

87 53

Serial No. 87,323—#5
Washington, D. C.

The relation of the counts of the interference to the claims is as follows:

Counts	Williams	Allen	Neitzel	Powell	Lewis	Erickson	Johnston	Cox	Simmons
1	15	13	18	8	10	16	6	7	23
2	16	14	19	9	11	17	7	8	24
3	17	15	20	10	12	18	8	9	25
4	18	16	21	11	13	19	9	10	26
5	19	17	22	12	14	20	10	11	27
6	20	20	25	15	17	23	13	14	30
7	21	21	26	16	18	24	14	15	31
8	22	22	27	17	19	25	15	16	32
9	23	23	28	18	20	26	16	17	33
10	24	24	29	19	21	27	17	18	34
11	25	25	30	20	22	28	18	19	35
12	26	26	31	21	23	29	19	20	36

(Counts Compared)

[Written]: B.

Respectfully,

C. F. Krafft

Examiner, Division 38.

87 54

[Written]: A

2—079

INTERFERENCE

nterference No. 55940 Paper No. 13

ame, John T. Simmons,

erial No. 87,323,

itle, Method and Apparatus for Testing the Productivity of Formations Encountered in Wells.

iled, Feb. 10, 1926

nterference with Otto J. Allen, Conrad T. Neitzel, Charles L. Williams Ernest Powell, Guy V. Lewis, David Erickson, Edgar Clinton Johnston Ernest H. Cox

DECISIONS OF

aw Examiner, Interference dissolved as to cts. 1 & 10 only — Dated, NOV 1 1928

x'r of Interferences, Favorable — Dated, Sept. 20/29.

oard, ... Dated, ...

ommissioner .... Dated, ...

REMARKS:

....

....

....

....

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

87 55

Bryant:MEB

[Written]: B

Div. 38 Room 145 Paper No. 14

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

All communications respecting this application should give the serial number, date of filing, and name of the applicant

[Written]: Copy sent Assignee

Please find below a communication from the EXAMINER in charge of this application

Thomas E. Robertson
Commissioner of Patents

[Stamped]: OCT 5 - 1927

Applicant: John T. Simmons
Ser. No. 87,323
Filed Feb. 10, 1926
For Method and Apparatus for Testing the Productivity of Formations Encountered in Wells

[Stamped]: PATENT OFFICE OCT 10 1927
MAILED

. M. Mason,
IcGill Bldg.,
Vashington, D. C.

The case, above referred to, is forwarded to the Examiner of Interferences because it is adjudged to interfere ith others, hereafter specified. The question of priority ill be determined in conformity with the Rules. The terference will be identified as No. 55941 On or before OV 14 1927 the statement demanded by rule 110 must e sealed up and filed with the subject of invention, and ame of party filing it, indorsed on the envelope. The ibject-matter involved in the interferenc is

Count 1

Apparatus for testing a well containing drilling fluid, hich includes an empty string of pipe to be lowered in e well to adjacent the formation to be tested, means at e lower end of the pipe to receive a sample from the formation including an inlet opening into the pipe and a alve for controlling the inlet, means carried by the pipe r sealing the well above the inlet, the valve being positively controlled by movement of the pipe.

Count 2.

Apparatus for testing a formation encountered in a well ntaining drilling fluid, which includes a single string of pe to be lowered into the well to adjacent the formaon to be tested, a valved inlet at the lower end of the pe positively controlled from the top of the well by ovement of the pipe and a packer carried by the pipe ove the inlet.

The interference involves your application, above identified, an application for "Well Tester", filed by Otto J. Allen, whose post office address is 409 Sames-Moore Bldg., Laredo, Webb County, Texas, whose attorney is Hardway & Cathey; 428 Bankers Mortgage Bldg., Houston Texas; an application for "Well Testing Tools" filed by Conrad T. Neitzel; whose post office address is 2236 Live Oak Street, Dallas, Texas; whose attorney is Jack A. Schley, 904 Allen Bldg., Dallas, Texas, whose associate attorney is Alfred T. Gage; 3915 Legation St., Washington, D. C.; an application for "Method of and Apparatus for Testing

87 56

Serial No. 87,323—#2

Wells, filed by Charles L. Williams, whose post office address is 130 N. Negley Ave., Pittsburgh, Pa.; whose attorney is Archworth Martin, 513 Union Trust Bldg., Pittsburgh, Pa.; an application for "Well Testor" filed by Ernest Powell, whose post office address is Box 56A, Route 1, Von Orme, Texas; whose attorney is Jesse R. Stone, C/o Andrews, Streetman, Logue, & Mobley, Union National Bank Bldg., Houston, Texas; an application for "Well Testing Device" filed by Guy V. Lewis, whose post office address is Robert E. Lee Hotel, Laredo, Texas; whose attorney is Jesse R. Stone; of Andrews, Streetman, Logue & Mobley, Union National Bank Bldg., Houston, Texas; an application for "Oil Well Packers" filed by David Erickson, whose post office address is

Erickson Pattern Works, 508 Ohio Ave., Wichita Falls, Texas; whose attorney is Watson, Coit, Morse & Grindle, Mather Bldg., Washington, D. C.; an application for "Well Formation Testing Device" filed by Edgar Clinton Johnston, whose post office address is El Dorado, Union County, Arkansas; whose attorney is Clarence A. O'Brien, Security, Savings & Commercial Bank Bldg., Washington, D. C.; whose assignee is Johnston Formation Testing Corporation of El Dorado, Arkansas; an application for "Oil Well Testing Device" filed by Ernest H. Cox, whose post office address is Duncan, Stephens County, Oklahoma, and whose attorney is Eccleston & Eccleston, of Loan & Trust Bldg., Washington, D. C.

The relation of the counts of the interference to the claims is as follows:

87 57

Serial No. 87,323—#3

Counts	Allen	Neitzel	Williams	Powell	Lewis	Erickson	Johnston	Cox	Simmons
1	18	23	15	13	15	21	11	12	28
2	19	24	16	14	16	22	12	13	29

(Counts Compared)

Respectfully,

C. F. Krafft

Examiner, Division 38.

87 58

[Written]: B

INTERFERENCE.

Interference No. 55941 Paper No. 15

Name, John T. Simmons,

Serial No. 87,323,

Title, Method and Apparatus for Testing the Productivity of Formations Encountered in Wells

Filed, Feb. 10, 1926

Interference with David Erickson, Guy V. Lewis, Charles L. Williams Ernest H. Cox, Edgar Clinton Johnston, Otto J. Allen, Conrad T. Neftzel, Ernest Powell.

DECISIONS OF

Primary Examiner, ...	Dated, ...
Ex'r of Interferences, Consolidated with Intf 55940	Dated, Dec. 22/28
Board, ...	Dated, ...
Commissioner	Dated, ...

REMARKS:

....

....

....

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

87 59

[Written]: In map's 55,940 & 55,941

[Written]: 87,323—16

[Stamped]: DOCKET DIVISION MAR 10 1928 U. S. PATENT OFFICE

Div. No. 38 Room No. 145

[Stamped]: DOCKET DIVISION MAR 10 1928 U. S. PATENT OFFICE

ASSOCIATE POWER OF ATTORNEY.

Applicant John T. Simmons

Improvement in METHOD AND APPARATUS FOR TESTING THE PRODUCTIVITY OF FORMATIONS ENCOUNTERED IN WELLS

Filed February 10, 1926

Serial No. 87,323

In the U. S. Patent Office.

Hon. Commissioner of Patents:

Sir:—Please recognize Mason & Mason, a firm composed of C. A. Mason and John M. Mason, Washington Loan and Trust Building, Washington, D. C., Registry No. 12505, as....our....associates in the above-entitled application, and address all communications to them, substituting said firm for John M. Mason, heretofore appointed associate attorney.

Lyon & Lyon

Attorney of Record.

[Written]: 87 - 60

[Written]: #17 D.

[Stamped]: APPLICATION DIV. Oct 30 1929 U. S. PATENT OFFICE

10820

IN THE UNITED STATES PATENT OFFICE

John T. Simmons, :
Well Testing Devices, : Division 38, Room 145.
Filed Feb. 10, 1926, :
Ser. No. 87,323 :

The Honorable Commissioner of Patents,
Washington, D. C.

Sir:

Kindly amend as follows:

Cancel claims 23, 25, 34 and 35 and add the following claims:

[In margin]: (D 1)

¶18. ~~37~~. A method of testing the productivity of a formation encountered in a well containing drilling fluid involving the insertion of only a single string of pipe into the well to make a test, which includes lowering a test string into the well through the drilling fluid with a packer carried by the string and a valve inlet at the lower end of the string closed against the entrance of fluid from the well, setting the packer above the formation and opening the valve to permit cogna*nt* fluid from the formation to enter the inlet, closing the valve to prevent the subsequent entrance of fluid from the well through the inlet and releasing the packer, and raising

the test string with the inlet closed against entrance of fluid from the well to remove an entrapped sample.

¶19. ~~38.~~ An apparatus for testing the productivity of a formation in a well containing drilling fluid, comprising a string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to receive a fluid sample therefrom and to be raised out of the well to remove the entrapped sample, said pipe being closed

[Written]: 87 - 61

10821

John T. Simmons 87,323 -2-

[In margin]: (D 1 Contd)

against the flow of the drilling fluid as the pipe is lowered into the well, a packer carried by the pipe as the pipe is lowered into the well and adapted to be seated by manipulation of the pipe to seal off the well above the

[In margin]: Per. E. JK

, said packer adapted to be positively pressed against the walls of the formation to seal off the same

formation ^, and inlet to the pipe communicating with the well below the point at which the packer seals off the well, and means for controlling the inlet to permit fluid from the formation to enter the pipe while the packer is set and to prevent fluid from entering the pipe after the packer is released and the pipe is being raised out of the well.

[Written]: (Sig)

REMARKS

The interferences in which this application was involved having been terminated, the above amendment is made with the hope of securing immediate allowance. All of the claims remaining in the case stand allowed.

Claim 23 and claim 34 were found on a Motion to Dissolve to be unpatentable. These claims correspond to counts 1 and 10, respectively, of the interference 55940.

Cancelled claims 25 and 35 which stood allowed in this application, correspond to newly added claims 37 and 38. Claims 25 and 35 have been cancelled in accordance with the agreement with the Examiner to allow new claims 37 and 38 in place of the cancelled claims. At the interview the Examiner thought that the newly presented claims 37 and 38 were allowable over the art of record but that they were not patentably distinguished from claims 25 and 35'. It is therefore requested that the claims be cancelled without prejudice. Claim 37

[Written]: 87 - 62

10822

John T. Simmons 87,323 -3-

will be found to correspond with allowed claim 25 or count 3 of the interference 55940, except that the words "and the packer", the last three words of claim 25, are left out of the new claim 37. After the packer has done its work there is no necessity that it be removed from the well and it is quite obvious that claim 37 is allow-

able, in view of the allowance of claim 25. Claim 37 also contains the addition of the word "with" after "fluid" line 5, which has been added to put the claim in better shape.

Similarly with respect to claim 38, this claim corresponds exactly with claim 35, or count 11 of interference No. 55940, except that the words "and removed from" in lines 8 and 9 of claim 35, have been omitted from claim 38. This is for the same reason, i. e., that the packer having accomplished its purpose is not necessarily removed from the well and a claim therefore which would cover the situation where the packer is left in the well, should be allowed, the substance of the invention being the same whether the packer is removed or not. In actual practice, packers may be set in a well hole and left therein. Moreover, in the use of the Simmons apparatus, the rubber packer on the tapered sleeve is generally placed on sufficiently loose so that if the packer is so tightly wedged as to stick the pipe, the packer may be pulled off the pipe by elevating the pipe.

It is believed that the foregoing amendment places this application in condition for immediate allowance and such allowance is urgently requested.

Respectfully submitted,

JOHN T. SIMMONS

By Lyon & Lyon

Attorneys.

October 30, 1929.

[Written]: 87-63

Div. 38 Room ;45 Paper No. 18

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

kh/d Nov. 1, 1929

All communications respecting this application should give the serial number, date of filing, and name of the applicant.

Please find below a communication from the EXAMINER in charge of this application.

Thomas E. Robertson
Commissioner of Patents.

[Stamped]: MAILED NOV 1 1929

Applicant: J. T. Simmons
Ser. No. 87,323
Filed Method & apparatus
For for testing the productivity of formations encountered in wells

Mason & Mason

Wash. Loan & Trust Bldg
City

Responsive amdt. 10/30/29.

Claims 37 and 38 are allowed.

Claims 1 to 7, 24, 26 to 33, 36 to 38 stand allowed.p

The passing of this case to issue is postponed for the purpose of considering another possible interference and in the near future applicant will receive either notice of allowance or notice of another interference.

[Written]: JK

C. F. Krafft
Examiner.

87 - 64

Div. 38 Room 145 Paper No. 19
kh/d

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

All communications respecting this application should give the serial number, date of filing, and name of the applicant

Dec. 4, 1929

Please find below a communication from the EXAMINER in charge of this application.

Thomas E. Robertson
Commissioner of Patents.

[Stamped]: MAILED DEC 4 1929

Applicant: J. T. Simmons
Ser. No. 87,323
Filed 2/9/26
For Method & apparatus for testing the productivity of formations encountered in wells

Mason & Mason
Wash. Loan & Trust Bldg.,
City

Additional references of record:

Halliday	1,474,630	Nov. 20, 1923	166/20
"	1,510,669	Oct. 7, 1924	"

In view of the fact that new references have been discovered which were not cited in the record nor considered by the Law Examiner inter partes this case has been reconsidered as follows:

Claims 1 and 2 are rejected as being met by Halliday 1,510,669 who shows a body 34, open at 42, a packer 6 carried by the body and a bushing 31 carried by the casing 3 and rotatable with respect to 34 having passages to register with those on 34.

Claims 26-36 and 37 are rejected as being completely met by Halliday. Attention of the applicant may be called to the fact that Halliday's device can be manipulated to close all the ports and further manipulated to open only the ports below the packers whereby the device can be used as a well tester.

Attention of the applicant is called to the fact that this rejection is in agreement with certain rulings of the law examiner who granted the motion with regard to count 10 of the interference as not being patentable over Cooper, even though Cooper's device is not a well tester.

Claims 3-7, 24 and (37) stand allowed.

The declaration of the new interference is postponed until one of the cases will be placed in condition for allowance.

[Written]: TK

C. F. Krafft
Examiner.

[Written]: 107 87-65

[Written]: #20 E.

10823

[Stamped]: APPLICATION DIV. DEC 15 16 1929 U. S. PATENT OFFICE

[Stamped]: U. S. Patent Office DEC 16 1929 DIVISION 38

IN THE UNITED STATES PATENT OFFICE

In re application of	:	
	:	
J. T. Simmons	:	
Serial No. 87,323,	:	Div. 38
	:	Room 145
Filed Feb. 9, 1926	:	
Method and Apparatus for testing the Productivity of Formations Encountered in Wells.	:	

Hon. Commissioner of Patents
Washington, D. C.

Sir:--

Please amend the above entitled application ~~as follows~~:–

Claims 1 and 2, at the end of these claims, change the period to a comma, and insert —said packer adapted to be postively pressed against the walls of the formation to seal off the same—.

√Claim 26, line 3, cancel "packing for sealing the well" and insert therefor —packer adapted to be positively pressed against the walls of the formation to seal off the same—.

Claim 27, line 3 after "pipe" first occurrence, insert —said packer adapted to be positively pressed against the walls of the formation to seal off the same—.

[In margin]: (E 1)

Claim 28, line 7, after "inlet" insert /√—said means consisting of a packer adapted to be positively pressed against the walls of the formation to seal off the same—.√

Claim 29, line 6, at the end of the claim, change the period to a comma, and insert —said packer being adapted to be positively pressed against the walls of the formation to seal off the same—.

[Written]: 87 - 66

√ Claim 30, line 5, after "pipe" first occurrence, insert —adapted to be positively pressed against the walls of the formation to seal off the same—.

Claim 31, line 6, after "tested" insert —said sealing means being adapted to be positively pressed against the walls of the formation to seal off the same—.

[In margin]: note TK

after

√ Claim 32, line 7, (before) "tested" insert —said packer adapted to be positively pressed against the walls of the formation to seal off the same—.

√ Claim 33, line 7 after "pipe" insert —said packer adapted to be positively pressed against the walls of the formation to seal off the same—.

[In margin]: Canceled Per Amd't D. M. & M. M. & M.

~~Claim 34, change the period to a comma at the end of the claim, and add —said packer adapted to be positively pressed against the walls of the formation to seal off the same—.~~

~~Claim 35, line 10, after "formation" insert —said packer adapted to be positively pressed against the walls of the formation to seal off the same—.~~

Claim 36, line 7, after "inlet" first occurrence, insert —said sealing means adapted to be positively pressed against the walls of the formation to seal off the same—.

Claim 38, line 9 after "formation" insert—said packer adapted to be positively pressed against the walls of the formation to seal off the same—.

REMARKS.

Claim 37 is understood to be allowed.

Applicant has been informed that the rejection of this claim in the Official action of Dec. 4th, 1929 was a typographical error. The third line from the bottom of the page in this Official action, states that claim 37 stands allowed.

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The rejected claims have been amended pursuant to an interview with the Examiner having charge of this application. This has been done to facilitate the consideration of the case and to place the claims in better form. It is not admitted by applicant that the Halliday patents, cited in the last Official action; diclose the invention or meet the rejected claims. These patents both disclose means for cleaning out perforations in a well casing. The packing members in these devices act as pistons to move the liquid up and down in the well casing, as the pipe supporting the same is moved up and down. Both of these patents dis-

close two sets of pipes, and the apparatus cannot be used unless the string of pipes supporting the packer as well as the casing string be used. Referring to Halliday, No. 1,510,669, page 3, lines 8 to 20, it is stated that dogs 21

(which are mounted on the inner strong of pipe) engage perforations 2 as shown in Fig. 9. The perforations 2 are in outer casing 1. It will be apparent therefore, that in order to position the cleaner, it is necessary to anchor the cleaner, by having the dogs 21 which form part of the inner string of pipe, engage in perforations in the outer casing 1. It will also be apparent from an inspection of Halliday patent 1,474,630, that when the upper and lower sets of perforations 13 and 13′ are closed, that the perforations 13″ may be open for the purpose of allowing the cleaning fluid to be pumped down through the tubing string 16 and discharge through the ports 13′. It will be obvious that if this apparatus were used as a means for obtaining a sample, which function applicant's device is constructed to perform, that the fluids from the entire well would pass through the openings 2 in the casing and into the openings 13″. Similarly, if the openings 13″ were closed, fluids from the entire well would pass through the perforations 2 and into the openings 13 and 13′. In other words,

[Written]: 87 - 68

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the packers in the Halliday patents are not constructed or arranged to seal off the formation at any place, nor could they be so used. A careful reading of the specifications of each of the Halliday patents discloses that the Halliday devices were constructed for the purpose of cleaning oil well casings, and for no other purpose.

Allowance of the claims is requested.

Respectfully submitted,

J. T. Simmons

By Mason & Mason,

Associate Attorneys.

Washington, D. C.
December 13, 1929

[Written]: 87 - 69

INTERFERENCE

Interference No. 59515 Paper No. 21

Name, John T. Simmons

Serial No. 87,323

Title, Method & apparatus for testing the productivity of formations encountered in wells

Filed, Feb. 10, 1926

Interference with Edwards, Charles R.

....

....

DECISIONS ON MOTION

Law Examiner, ... Dated, ...

Board of Appeals, ... Dated, ...

MOTIONS

DECISIONS ON ~~PRIORITY~~

(Priority) EXAMINER OF INTERFERENCES

		Vacated May 7/32
	~~Adverse~~	~~Feb. 29/32~~
Ex'r of Interferences,	Dissolved	Dated, June 24/30
Board of Appeals,	Reversed	Dated, Feb. 17-1931
Court,	....	Dated, ...

REMARKS:

Ex'r of Intfs Decisions on Priority } Adverse (Dated) Dec. 21/32.

"

Board of Appeals. Reversed May. 16-1933

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

[Written]: 87 - 70

Div. 38 Room 145 Paper No. 22

COUNTS COMPARED

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name
kh/d

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

All communications respecting this
application should give the serial number,
and date of filing and name of
the applicant

[Stamped]: U. S. PATENT OFFICE INTERFERENCE DIV. JAN 30 1930 MAILED

[Written]: (Copy sent assignee.)

Please find below a communication from the EXAMINER in charge of this application

Thomas E. Robertson
Commissioner of Patents

Applicant: J. T. Simmons
Ser. No. 87,323
Filed 2/10/26
For Method & apparatus for testing the productivity of formations encountered in wells.

Mason & Mason

Wash. Loan & Trust Bldg;
Washington, D. C.

The case, above referred to, is forwarded to the Examiner of Interferences because it is adjudged to interfere with others, hereafter specified. The question of priority will be determined in conformity with the Rules. The interference will be identified as No. 59515 On or before MAR 10 1930 the statement demanded by rule 110 must be sealed up and filed with the subject of invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

Count 1

A method of testing the productivity of a formation encountered in a well containing drilling fluid, which includes lowering an empty string of pipe into the well through the drilling fluid to adjacent the formation, the pipe carrying a packer and having a valved inlet at its lower end which is closed while the pipe is being lowered, setting the packer above the formation to seal off the drilling fluid from the formation, opening the valved inlet after the packer is set to permit cognate fluid from the formation to enter the pipe, closing the valved inlet against the entrance of fluid from the well by movement of the pipe, raising the pipe so closed to remove an entrapped sample and the packer from the well.

Count 2

Apparatus for testing a well comprising a string of pipe to be lowered into a well having an inlet at its lower end and carrying a packer adapted to be positively pressed against the walls of the formation to seal off the same above the inlet, and a valve for the inlet positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

Count 3

Apparatus for testing a well comprising a string of pipe to be lowered into the well, a packer carried by the pipe said packer adapted to be positively pressed against the walls of the formation to seal off the same and means at the lower end of the pipe to receive a sample from the well including an inlet and a valve for controlling the inlet, the valve being positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

Count 4

Apparatus for testing a well containing drilling fluid, which includes an empty string of pipe to be lowered in the well to adjacent the formation to be tested, means at the lower end of the pipe to receive a sample from the formation including an inlet opening into the pipe and a valve for controlling the inlet, and means carried by the pipe for sealing the well above the inlet said means consisting of a packer adapted to be positively pressed against the walls of the formation to seal off the same, the valve

[Written]: 87-71

being positively controlled by movement of the pipe.

Count 5

Apparatus for testing a formation encountered in a well containing drilling fluid, which includes a single string of pipe to be lowered into the well to adjacent the formation to be tested, a valved inlet at the lower end of the pipe positively controlled from the top of the well by movement of the pipe and the packer carried by the pipe above the inlet, said packer being adapted to be positively pressed against the walls of the formation to seal off the same.

Count 6

Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, which includes an empty string of pipe to be lowered into the well to adjacent the formation to be tested, a packer carried by the pipe adapted to be positively pressed against the walls of the formation to seal off the same, means at the lower end of the pipe to receive a sample from the formation including an inlet opening into the pipe and a valve structure for controlling the inlet, the valve structure including a plurality of relatively movable parts one of which is secured to the pipe and another of which is connected to the packer.

Count 7

Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, which includes a single empty string of pipe to be lowered into the well to adjacent the formation to be tested, means lowered into the well by said string of pipe for sealing off the drilling fluid from the formation to be tested said ceiling means being adapted to be positively pressed against the walls of the formation to seal off the same, means at the lower end of said string of pipe to receive a sample from the formation including an inlet opening into said pipe and a valve structure for controlling the inlet, said valve structure including a part connected to said sealing means and a part connected to said pipe.

Count 8

Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, comprising a single empty string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to be tested, a packer lowered into the well by said string of pipe for sealing off the drilling fluid from the formation to be tested said packer adapted to be positively pressed against the walls of the formation to seal off the same. means at the lower end of said string of pipe to receive fluid from formation including an inlet opening into said pipe below said packer and a valve structure for controlling the inlet, said valve structure having a relatively stationary

part connected to the packer and a relatively movable part connected to the pipe.

Count 9

Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, comprising a single empty string of pipe to be lowered into the well through the drilling fluid to adjacent the/formation to be tested, a packer carried by the pipe for sealing off the well above the formation an inlet below the packer opening into the pipe said packer adapted to be positively pressed against the walls of the formation to seal off the same, and a valve for the inlet, the setting of the packer and the operation of the valve being positively controlled by movement of the pipe.

Count 10

Apparatus for testing a well containing drilling fluid, comprising a single string of pipe to be lowered into the well through the drilling fluid, said pipe being closed against the entrance of the drilling fluid, means at the lower end of the pipe

[Written]: 87 - 72

for receiving a sample including an inlet opening into the pipe, means carried by the pipe for sealing the well above the inlet said sealing means adapted to be positively pressed against the walls of the formation to seal off the same, and a valve for the inlet that may be positively opened and closed by movement of the pipe while the well is sealed above the inlet.

Count 11

A method of testing the productivity of a formation encountered in a well containing drilling fluid involving the insertion of only a single string of pipe into the well to make a test, which includes lowering a test string into the well through the drilling fluid with a packer carried by the string and a valve inlet at the lower end of the string closed against the entrance of the fluid from the well, setting the packer above the formation and opening the valve to permit cognate fluid from the formation to enter the inlet, closing the valve to prevent the subsequent entrance of fluid from the well through the inlet and releasing the packer, and raising the test string with the inlet closed against entrance of fluid from the well to remove an entrapped sample.

Count 12

An apparatus for testing the productivity of a formation in a well containing drilling fluid, comprising a string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to receive a fluid sample therefrom and to be raised out of the well to remove the entrapped sample, said pipe being closed against the flow of the drilling fluid as the pipe is lowered into the well,

a packer carried by the pipe as the pipe is lowered into the well and adapted to be seated by manipulation of the pipe to seal off the well above the formation said packer adapted to be positively pressed against the walls of the formation to seal off the same, an inlet to the pipe communicating with the well below the point at which the packer seals off the well, and means for controlling the inlet to permit fluid from the formation to enter the pipe while the packer is set and to prevent fluid from entering the pipe after the/packer is released and the pipe is being raised out of the well.

The interference involves your application above identified and an application for, Testing device for wells, filed by Charles R. Edwards whose post office address is 413 West 13th Avenue, Houston, Texas, whose attorney is Hardway & Cathey, 428 Bankers Mortgage Bldg; Houston, Texas.

The relation of the counts of this interference to the claims of the respective parties is as follows:

Counts	Edwards	Simmons
1	36	24
2	85	26
3	86	27
4	87	28
5	88	29
6	89	30
7	90	31
8	91	32
9	92	33
10	93	36
11	46	37
12	94	38

C. F. Krafft

Examiner, Div. 38.

[Written]: 87 - 73

Div. 38 Room 7510 Serial No. 87,323

Kh:WS

Address Only
The Commissioner of Patents
Washington, D. C.

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

September Thirteen, 1933

[In margin]: ☞ IN REMITTING THE FINAL FEE GIVE THE SERIAL NUMBER AT THE HEAD OF THIS NOTICE.

[In margin]: ☞ UNCERTIFIED CHECKS WILL NOT BE ACCEPTED.

John T. Simmons (Assor)

Your APPLICATION for a patent for an IMPROVEMENT in Method and Apparatus for Testing the Productivity of Formations Encountered in Wells filed Feb. 10, 1926 has been examined and ALLOWED with 19 claims.

The final fee, THIRTY DOLLARS, WITH $1 AD-
)ITIONAL FOR EACH CLAIM ALLOWED IN EX-
CESS OF 20, must be paid not later than SIX MONTHS
rom the date of this present notice of allowance. If the
nal fee be not paid within that period, the patent will
e withheld, but the application may be renewed within
ne year after the date of the original notice with a re-
ewal fee of $30 and $1 additional for each claim in ex-
ess of 20.

The office delivers patents upon the day of their date,
n which date their term begins to run. The preparation
f the patent for final signing and sealing will require
bout four weeks, and such work will not be begun until
fter payment of the necessary final fee.

When the final fee is paid, there should also be sent,
)ISTINCTLY AND PLAINLY WRITTEN, the name
f the INVENTOR, TITLE OF THE INVENTION,
ND SERIAL NUMBER AS ABOVE GIVEN, DATE
)F ALLOWANCE (which is the date of this circular),
)ATE OF FILING, and, if assigned, the NAMES OF
'HE ASSIGNEES.

If it is desired to have the patent issue to an AS-
IGNEE OR ASSIGNEES, an assignment containing a
REQUEST to that effect, together with the FEE for
ecording the same, must be filed in this office on or before
ne date of payment of the final fee.

After issue of the patent, uncertified copies of the drawings and specifications may be purchased at the price of TEN CENTS EACH. The money should accompany the order. Postage stamps will not be received.

The final fee will NOT be received from other than the applicant, his assignee or attorney, or a party in interest as shown by the records of the Patent Office.

NOTICE.—WHEN THE NUMBER OF CLAIMS ALLOWED IS IN EXCESS OF 20, NO SUM LESS THAN $30 PLUS $1 ADDITIONAL FOR EACH CLAIM IN EXCESS OF TWENTY CAN BE ACCEPTED AS THE FINAL FEE.

Respectfully,

Conway P. Coe
~~Thomas E. Robertson~~
Commissioner of Patents.

Mason & Mason
Wash. Loan & Trust Bldg.
Washington, D. C.

[Written]: 87-74

SEP-19-33 49095 K — Check — 30.00

327

U. S. Patent Office

[Stamped]: MAIL. DIVISION SEP 19-33 U. S. PATENT OFFICE

FINAL FEE PAID TO THE COMMISSIONER OF PATENTS

(Be careful to give correct Serial No.)

[In margin]: 1 1 19 — 1√

Serial No. 87,323 √

INVENTOR:

John T. Simmons √

PATENT TO BE ISSUED TO

as of record

NAME OF INVENTION, AS ALLOWED:

Method & Ap. for Testing Productivity of Formations Encountered in Wells

DATE OF PAYMENT:

Sept. 18, 1933

FEE:

Thirty dollars

DATE OF FILING:

Feb. 10, 1926

DATE OF CIRCULAR OF ALLOWANCE:

Sept. 13, 1933 √

The Commissioner of Patents will please apply the accompanying fee as indicated above.

Lyon & Lyon
Attorneys.

SEND PATENT TO

Lyon & Lyon
National City Bank Bdg.
Los Angeles, Calif.

Final fees will not be received from other than the applicant, his assignee or attorney, or a party in interest as shown by the records of the Patent Office.

[Written]: 87-75

(Patent)

[For copy of this patent 1,930,987, filed Feb. 10, 1926, see Plaintiffs' Exhibit 1 heretofore set forth.]

#23

[Stamped]: MAIL ROOM NOV 20 1933 U. S. PATENT OFFICE

DISTRICT COURT OF THE UNITED STATES
Southern District of California, Northern Division

Honorable Commissioner of Patents,
Washington, D. C.

Sir:

In compliance with the Act of February 18, 1922 (42 Stat. L. 392), you are advised that there was filed on the 3rd day of November, 1933, in this court an action, suit, or proceeding No. D-56 Equity, entitled:

Name Erle P. Halliburton and Halliburton Oil Well Cementing Company, a corporation, Plaintiff,

Address a resident of Los Angeles and a corporation of Delaware, resp.

versus

Name Honolulu Oil Corp., Ltd. a corp and M. O. Johnston Oil Field Service Corporation, a corp, Defendant,

Address of corporation Delaware and California resp, place of business Kern County and Los Angeles County, Respectively,

brought upon the following patents:

Patent No.	Date of Patent	Patentee
1 1930987	Oct. 17, 1933	Erle P. Halliburton
2		
3		
4		
5		

In the above-entitled case, on the .... day of ...., 192 , the following patents have been included by .... (insert amendment, answer, cross bill, or other pleading):

Patent No.	Date of Patent	Patentee
1		
2		
3		
4		
5		

In the above-entitled case the following decision has been rendered or decree issued:

....

....

IN WITNESS WHEREOF I have affixed my hand this 16th day of November, 1933, at Los Angeles, California

R. S. Zimmerman,
Clerk of said Court.

Francis E. Cross
Francis E Cross

[Written]: 87 - 76
#24.

[Stamped]: MAIL DIVISION JAN 19-34 U. S. PATENT OFFICE

[Stamped]: DOCKET DIVISION JAN 19 1934 U. S. PATENT OFFICE

IN THE UNITED STATES PATENT OFFICE
DIVISION 38, ROOM 7510

Houston Texas, Jan. 3, 1934.

In re patent No. 1,930,987,
Issued to John T, Simmons,
and to Erle P. Halliburton,
On Oct. 17, 1933, on
Application No. 87,323,
Filed Feb. 10, 1926,
For "A method and Apparatus
for Testing the Productivity
of Formations Encountered in Wells."
Commissioner of Patents,
Washington, D. C.

Sir:–

So that the proper notices may be entered on the file wrapper of the above patent application this is to inform you that under the provissions of the United States Revised Statutes Sec. 4915 (35 U. S. C. A. 63) suits were filed as follows to authorize the issuance of Letters Patent involving application Serial No. 301,762 and Patent No. 1,930,987, that in each case Charles R. Edwards is the

plaintiff and that in each case the defendants are (1) John T. Simmons, (2) Erle P. Halliburton and (3) Halliburton Oil Well Cementing Company:

> December 20, 1933, Equity 671 in United States District Court, Tyler Division, Eastern District of Texas, at Tyler,

and on:

> December 21, 1933, Equity No. 134-C, in United States District Court, Central Division, Southern District of California, at Los Angeles, Cali.,

and on

> December 22, 1933, Equity No. 56,598, in the Supreme Court of the District of Columbia, Washington, D. C.

That these suits are a continuation of Patent Office Interference No. 59,515, Edwards vs Simmons.

Please acknowledge receipt of this notice and accept in advance my thanks for the same.

Very respectfully,

Charles R Edwards
plaintiff and applicant

Box 7334

[Written]: 87 - 77

#25

[Stamped]: MAIL ROOM DEC 27 1933 U. S. PATENT OFFICE

DISTRICT COURT OF THE UNITED STATES
Southern District of California

Honorable Commissioner of Patents,
Washington, D. C.

Sir:

In compliance with the Act of February 18, 1922 (42 Stat. L. 392), you are advised that there was filed on the 21st day of December, 1933, 192 , in this court an action, suit, or proceeding No. 134 C. Eq., entitled:

Name Charles R. Edwards, Plaintiff,

Address Houston, Texas

versus

Name John T. Simmons, Erle P. Halliburton and Halliburton Oil Well Cementing Company a corporation, Defendant,

Address Simmons is of Texas; Halliburton and Halliburton Oil Well Cementing Co. are of Los Angeles Calif and Duncan Okla respectively,

brought upon the following patents:

Patent No.	Date of Patent	Patentee
301762	....	Charles R. Edwa
1 1930987	Oct. 17, 1933	John T. Simmon
2..................	....	....
3..................	....	....
4..................	....	....
5..................	....	....

In the above-entitled case, on the .... of ...., 192 , the following pat have been included by .... (in amendment, answer, cross bill, or other pleading):

Patent No.	Date of Patent	Patentee
1..................	....	....
2..................	....	....
3..................	....	....
4..................	....	....
5..................	....	....

In the above-entitled case the following decision has b rendered or decree issued:

....

....

IN WITNESS WHEREOF I have affixed my h this 23rd day of December, 1933, 192 , at Los Ang California,

R. S. Zimmerman,
Clerk of said Cour
Francis E. Cross
Francis E. Cross

[Written]: 87-7

#26

[Stamped]: MAIL ROOM JAN 31 1934 U. S. PATENT OFFICE

DISTRICT COURT OF THE UNITED STATES
Eastern District of Texas

Honorable Commissioner of Patents,
Washington, D. C.

Sir:

In compliance with the Act of February 18, 1922 (42 Stat. L. 392), you are advised that there was filed on the 20th day of December, 1933, in this court an action, suit, or proceeding No. 671, entitled:

Name Charles R. Edwards, Plaintiff,

Address 413 West 13th Ave., Houston, Texas

versus

Name John T. Simmons, Southern Hotel, Longview, Texas,

Erle P. Halliburton, 810 S. Spring St., Los Angeles, California

Halliburton Oil Well Cementing Co., a corp., Duncan, Okla. Defendant,

Address ....

brought upon the following patents:

Patent No.	Date of Patent	Patentee
1 301,762 – application filed Aug. 24, 1928 by Charles R. Edwards		
2 1,930,987	Oct. 17, 1933	John T. Simmons, assigned to Erle P. Halliburton.
3........................	....	
4........................	....	
5........................	....	....

In the above-entitled case, on the........day of.................., 1934, the following patents have been included by............ (insert amendment, answer, cross bill, or other pleading):

Patent No.	Date of Patent	Patentee
1........................	....	....
2........................	....	....
3........................	....	....
4........................	....	....
5........................	....	....

In the above-entitled case the following decision has been rendered or decree issue:

....

....

IN WITNESS WHEREOF I have affixed my hand this 29th day of January, 1934, at Tyler, Texas

F. A. King
Clerk of said Court.

87 — 79

[Stamped]: Mail Room Jan 31 1934 U. S. Patent Office

DISTRICT COURT OF THE UNITED STATES
Eastern District of Texas, Tyler Division

Honorable Commissioner of Patents,
Washington, D. C.

Sir:

In compliance with the Act of February 18, 1922 (42 Stat. L. 392), you are advised that there was filed on the 25th day of January, 1934, in this court an action, suit, or proceeding No. 693, entitled:

Name Erle P. Halliburton and Halliburton Oil Well Cementing Co., a corp., Plaintiff,

Address Los Angeles, Calif. —Delaware Corp.

versus

Name Johnston Formation Testing Corp., a corp. and E. C. Johnston, Defendant,

Address Delaware Corp., — E. C. Johnston, Pres. resides Longview, Texas

brought upon the following patents:

	Patent No.	Date of Patent	Patentee
1	1930987	Oct. 17, 1933	Erle P. Halliburton
2			
3			
4			
5			

In the above-entitled case, on the........day of..................
193 , the following patents have been included by...........
(insert amendment, answer, cross bill, or other pleading):

	Patent No.	Date of Patent	Patentee
1			
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3			
4			
5			

In the above-entitled case the following decision has been rendered or decree issued:

....

....

IN WITNESS WHEREOF I have affixed my hand this 29th day of January, 1934, at Tyler, Texas

F. A. King
Clerk of said Court.

87 — 80

#28

[Stamped]: Mail Room Mar 28 1934 U. S. Patent Office

DISTRICT COURT OF THE UNITED STATES
Southern District of California, Central Division

Honorable Commissioner of Patents,
Washington, D. C.

Sir:

In compliance with the Act of February 18, 1922 (42 Stat. L. 392), you are advised that there was filed on the 12th day of March, 1934, ~~192~~ , in this court an action, suit, or proceeding No. 199-H Equity, entitled:

Name Erle P. Halliburton and Halliburton Oil Well Cementing Company, a corp., Plaintiff,

Address Los Angeles, Calif.

versus

Name W. D. Shaffer, doing business under the firm name and style of Shaffer Tool Works and M. L. Boles Defendant,

Address Brea, Calif. Whittier, Calif.

brought upon the following patents:

Patent No.	Date of Patent	Patentee
1 1,930,987	10/17/33	Erle P. Halliburton
2		
3		
4		
5		

In the above-entitled case, on the........day of.................., 192 , the following patents have been included by.......... (insert amendment, answer, cross bill, or other pleading):

Patent No.	Date of Patent	Patentee
1		
2		
3		
4		
5		

In the above-entitled case the following decision has been rendered or decree issued:

....

....

IN WITNESS WHEREOF I have affixed my hand this 24th day of March, 1934, ~~192~~, at Los Angeles, California

R. S. ZIMMERMAN
Clerk of said Court.

M. R. Winchell
By M. R. Winchell
Deputy Clerk.

87 — 81

TITLE REPORT

No. 1,930,987.

Name J. T. Simmons

The title appears from the assignment records to be vested in:

Erle P. Halliburton, Los Angeles, Calif.
(no street address given)

Examined up to and including 9/4/34

This certificate dated 9/13/34

C. H. Gray

h Chief of Assignment Division.

No further assignments appear to have been received for record including 9/10/34

87 — 82

[Stamped]: Mailed Oct 23 1934

Div. 38 Room 5086 213 Paper No. 29

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name
kh/d

All communications respecting this application should give the serial number, date of filing, and name of the applicant

DEPARTMENT OF COMMERCE
United States Patent Office
Washington

Please find below a communication from the
EXAMINER in charge of this application
~~Thomas E. Robertson~~

Conway P. Coe
Commissioner of Patents

Applicant: John T. Simmons
Ser. No.:...87,323
Filed............Feb. 10, 1926
For:..............Well testing devices
Patented Oct. 17, 1933
Patent #1,930,987

Mason and Mason
Washington Loan and Trust Building,
Washington, D. C.

The case, above referred to, is forwarded to the Examiner of Interferences because it is adjudged to interfere with others, hereafter specified. The question of priority will be determined in conformity with the Rules. The

interference will be identified as No. 69519 On or before Dec 3 1934 the statement demanded by rule 110 must be sealed up and filed with the subject of invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

Count 1

A well testing device comprising a body part having a lower pin projecting therefrom and forming a shoulder with the body part, a downwardly tapering packer surrounding said pin for engaging against said shoulder, and means at the lower end of said pin for constituting an abutment for said packer, said body part and pin having a passage therethrough, and means adjoining the upper end of said body part for opening and closing the communication of this passage with the casing above.

Count 2

A well testing device comprising a body part having a pin extending from the lower part thereof, said body part and pin having a passage therethrough, a packer extending about said pin; an adjusting sleeve on the lower end of said pin, a perforated pipe secured to the lower end of said sleeve, and means above the body part for regulating the communication of the passage with the interior of the casing above.

The interference involves your patent above identified and an application for Apparatus for obtaining samples from drilled wells filed by George A. Macready whose post office address is 5425 Chesley Avenue, Los Angeles, California.

The relation of the counts of the interference to the claims of the respective parties is as follows:

87—83

Counts	Macready.	Simmons
1	9	6
2	10	7

C. F. Krafft
Examiner

FK

87 — 84

INTERFERENCE

Interference No. 69519 Paper No. 30
Name, John T Simmons
Serial No. 87,323 Patent #1,930.987
Title, Well testing devices
Filed, Feb. 10, 1926 Patented Oct. 17, 1933
Interference with G. A. Macready

....

....

DECISIONS ON MOTION

Ex'r of Interferences, ... Dated, ...
Board of Appeals, ... Dated, ...

DECISIONS ON PRIORITY

Ex'r of Interferences, ... Dated, ...
Board of Appeals, ... Dated, ...
Court, ... Dated, ...

REMARKS:

....

....

....

....

....

....

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

87—85

~~2—121~~

1926

CONTENTS:

29. Intf Letter Oct 23 1934
30. Intf Memo.
31. ....
32. ....
33. ....
34. ....
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36. ....
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50. ....

[Stamped]: U. S. Patent Office Feb 13 1926 Division 38
87323 86

[Stamped on back]: Assembled by M.H. Revised by........
Letter No. 135617 Date 10/28/35

No. D-56-Eq. Halliburton, et al. vs. Honolulu Oil Corp. Plfs. Exhibit No. 2. Filed 11/11 1935 R. S. ZIMMERMAN, Clerk by Cross Deputy Clerk.

[PLAINTIFFS' EXHIBIT No. 3.]

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE

To all persons to whom these presents shall come, Greeting:

THIS IS TO CERTIFY that the annexed is a true copy from the records of this office of Papers 40, 114, and 119; and Pages 1, 2 and 4 of Index, in the matter of

Interference Number 59,515,
Edwards vs. Simmons,
Subject Matter:–
Testing Device for Wells.

In Testimony whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this twenty-ninth day of October, in the year of our Lord one thousand nine hundred and thirty-five and of the Independence of the United States of America the one hundred and sixtieth.

[Seal]

Conway P. Coe
Commissioner of Patents.

Attest:
C. W. Sutton
Acting Chief of Division.

[Stamped on face]: U. S. Patent Office Board of Appeals Feb 17 1931 Mailed.

Appeal No. 286-287 Paper No 40

Decision.

Appeal No. 286-287 OVT

Hearing:

January 27, 1931

IN THE UNITED STATES PATENT OFFICE

BEFORE THE BOARD OF APPEALS

Edwards vs. Simmons

Patent Interference No. 59,515 between an application of Charles R. Edwards filed August 24, 1928, Serial No. 301,762; and an application of John T. Simmons filed February 10, 1926, Serial No. 87,323. Testing Device for Wells.

Messrs. Hardway & Cathey and Messrs. Foster & Codier for Edwards.

Messrs. Lyon & Lyon and Messrs. Mason & Mason for Simmons.

MOTION TO DISSOLVE

This is an appeal by the party Simmons from the decision by the Examiner of Interferences on a motion to dissolve holding all of the counts 1-12 inclusive unpatentable.

The party Edwards has also appealed from so much of the decision of the Examiner of Interferences which relates to Simmons' right to make count 2. The Examiner of Interferences held that Simmons could make the count and hence this question is not appealable. The appeal of the party Edwards will therefore be dismissed.

59515 1

Counts 1 and 3 are reproduced below:

1. A method of testing the productivity of a formation encountered in a well containing drilling fluid, which includes lowering an empty string of pipe into the well through the drilling fluid to adjacent the formation, the pipe carrying a packer and having a valved inlet at its lower end which is closed while the pipe is being lowered, setting the packer above the formation to seal off the drilling fluid from the formation, opening the valved inlet after the packer is set to permit cognate fluid from the formation to enter the pipe, closing the valved inlet against the entrance of fluid from the well by movement of the pipe, raising the pipe so closed to remove an entrapped sample and the packer from the well.

3. Apparatus for testing a well comprising a string of pipe to be lowered into the well, a packer carried by the pipe said packer adapted to be positively pressed against the walls of the formation to seal off the same and means at the lower end of the pipe to receive a sample from the well including an inlet and a valve for controlling the inlet, the valve being positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

The references relied upon are:

Franklin	263,330	Aug. 29, 1882
Edwards	1,514,585	Nov. 4, 1924
Macready	1,522,197	Jan. 6, 1925
Macready	1,776,918	Sep. 30, 1930

The invention relates to a method and apparatus for testing an oil well. The method comprises lowering a string of pipe carrying a packer through the drilling fluid to the oil formation, setting the packer to seal off the entrance of drilling fluid from above to the formation, opening an inlet valve to the pipe to admit oil, closing the inlet valve from entrance of drilling fluid and then raising the pipe with the entrapped sample.

In holding counts 1 and 11 covering methods unpatentable, the Examiner of Interferences relies on the Edwards patent No. 1,514,585. This patent describes fully how the patentee contemplated using his device for testing. The

59515 2

drill pipe 1 with the nipple 4 and the perforated lower end attached to the packer 5 is first lowered to the bottom of the well; then the test stem 8 together with the sleeve 7 is lowered to a point above the seat 6 and water is pumped down through the pipe 1 past the stem 8 and seat 6 to below the packer to wash out the stratum to be tested. The packer 5 is then raised, tripped and set. The test stem 8 is then seated on the seat 6 and the slush pump started pumping in mud down the pipe 1 out through the perforations 10 in the pipe 1 and up to maintain the wall. After a while the stem 8 is turned to the right to unscrew it from the sleeve 7 and the stem 8 is lowered. The oil below the packer 5 will now pass through the perforations in the stem 8 and rise up in the stem and pass out at the top if there is sufficient pressure. If there is not sufficient pressure a pump may be used to pump it out, thus completely testing the stratum.

The last paragraph of the specification states: "To withdraw the apparatus the packer is first released before stopping the slush pump and the test stem is then withdrawn before withdrawing the drill pipe and packer."

It is clear that the patent specification does not describe the same method of testing as covered by counts 1 and 11. Count 11 calls for the insertion of a single string of pipe which is a material limitation and cannot be disregarded. The Edwards patent clearly contemplates the use of two strings of pipe. The difficulty of manipulation and loss of time incident thereto in making a test with two strings of pipe as compared with testing with a single string is so obvious that the distinction is a material

one. Count 1 includes "closing the valved inlet against the entrance of fluid from the well by movement of the pipe, raising the pipe so closed to remove an entrapped sample and packer from the well." Count 11 contains a similar limitation. The patent does not describe such operation of closing the valve and raising the pipe to remove an entrapped sample. Nowhere in the patent is there any indication of entrapping a sample and raising the pipe so the sample can be examined. If the packer 5 in the patent is released as stated in the specification while the stem 8 is down the drilling fluid would immediately enter the stem 8 through the perforations and contaminate the oil sample. The patent contemplates a different method of operation and in carrying it out both of the pipes 1 and 8 are essential and the pipe 1 must carry a packer. We do not believe it proper to take a portion of the device such as the stem 8 and sleeve 7 and exclude other essential parts and try to make out an anticipation for the counts when the patent states nothing about such a mode of operation. It is also doubtful that the parts 7 and 8 could be used to carry out the methods recited by the counts, and considerable modification of them would be required which would involve invention. Unless the sleeve 7 was constructed so as to pack, and unless the stem 8 could be maintained closed during the raising of the stem, no accurate entrapped sample could be obtained. When the pressure of the drilling fluid is large the fluid would evidently enter the stem 8 unless the stem could be screwed back into the sleeve 7. There is no disclosure of this in the patent.

The apparatus claims 2-10 and 12 have been held unpatentable in view of the disclosure in the Franklin patent considered in connection with Macready. The Franklin patent discloses a device for regulating or controlling the flow of oil wells. It consists of a valve structure shown in Figs. 1 and 2 which is intended to be atached to the tubing of the well preferably above the packer. When the tubing is placed in the well or is withdrawn from it the valve disk may be closed by turning the upper part of the tubing and thus prevent flowing of oil. The Examiner of Interferences holds that the lower part of the valve structure, namely part B, could be used as a packer to fit in a rat hole in view of Macready 1,522,197 and thus anticipate these counts. We are unable to take this view. The Franklin patent was not designed to have the part B serve the function of a packer. The part B happens to be somewhat tapered but otherwise there is no suggestion that it could be used as a packer. Nor do we think that the Macready patent would supply what the Franklin patent lacks. We have noted the statements concerning the Franklin patent made by Judge Hutcheson in his decision involving the Edwards patent. However, the general statement made that the device of Franklin could be modified to be used as a tester gives no clue as to what modifications were contemplated.

The Macready patent discloses the use of a packer on a tester. This is admittedly old not only in this patent but in many other patents in the record. But we do not believe that these patents suggest how the Franklin structure

can be modified to meet these counts. The Franklin structure was devised years before any packers were used and it was never intended to function as a tester when it was constructed.

The brief of the party Edwards lays stress upon the limited original disclosure of Simmons and urges that in view of it the counts do not define anything patentable over the references. The Examiner of Interferences held that Simmons could make the counts so that seems to remove this objection.

The appeal of the party Edwards is dismissed.

The decision of the Examiner of Interferences is reversed.

Wm. A. Kinnon	)	
First Assistant Commissioner	)	
	)	
W. L. Redrow	)	BOARD
Examiner-in-Chief	)	OF
	)	APPEALS
R. Elmburg	)	
Examiner-in-Chief	)	
	)	

February 17, 1931

59515 6

[Stamped on face]: U. S. Patent Office Board of Appeals May 16 1933 Mailed.

8322

Appeal No. 8422 Paper No. 114

Decision

Appeals Nos. 8322-8422 MCV

Hearing:
April 28, 1933.

IN THE UNITED STATES PATENT OFFICE

BEFORE THE BOARD OF APPEALS

Edwards v. Simmons

Patent Interference No. 59,515 between the applications of Charles R. Edwards filed Aug 24, 1928, Serial No. 301,762 and John T. Simmons filed February 10, 1926, Serial No. 87,323. Testing Device for Wells.

Messrs. Hardway & Cathey, Messrs. Foster & Codier, and Messrs. Jesse R. Stone and Lester B. Clark for Edwards.

Messrs. Lyon & Lyon and Messrs. Mason & Mason for Simmons.

This is an appeal by the party Simmons from the decision of the Examiner of Interferences awarding priority of invention to Edwards of all the counts.

The subject matter in controverwsy relates to devices for testing oil wells and the purpose of such testers is to ascertain whether there exists in a predetermined portion of the formation a sufficient quantity of oil or gas so that production would be practicable.

There are twelve counts. Counts 3 and 11 may be taken as representative and read as follows:

> 3. Apparatus for testing a well comprising a string of pipe to be lowered into the well, a packer carried by the pipe said packer adapted to be positively pressed against the walls of the formation to seal off the same and means at the lower end of the pipe to receive a sample from the well including an inlet and a valve for controlling the inlet, the valve being positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

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> 11. A method of testing the productivity of a formation encountered in a well containing drilling fluid involving the insertion of only a single string of pipe into the well to make a test, which includes lowering a test string into the well through the drilling fluid with a packer carried by the string and a valve inlet at the lower end of the string closed against the entrance of fluid from the well, setting the packer above the formation and opening the valve to permit cognate

fluid from the formation to enter the inlet, closing the valve to prevent the subsequent entrance of fluid from the well through the inlet and releasing the packer, and raising the test string with the inlet closed against entrance of fluid from the well to remove an entrapped sample.

The examiner of interferences awarded priority to the junior party Edwards on the ground that Simmons had derived the invention from Edwards and was not therefore an original inventor.

The party Edwards testified that he conceived the invention in 1917 while being employed at the International Marine Iron Works in Houston, Texas. A sketch was made of the invention on some object in the shop and shown to a visitor. A sketch was also later made in a note-book, Exhibit 33, and a vest pocket model, Exhibit 7, was constructed. Edwards testifies that sometime later he explained the invention to George Watkin, who pointed out the danger of the device becoming stuck in a well. During the strike of the machinists in the shop in 1918 and the early part of 1919, Edwards states, he made a tool embodying the issue and showed it to George Watkin, Mrs. Watkin and Mrs. Edwards. The tool was taken to Edwards' home and was reassembled. Edwards testifies that he later became shop superintendent for the Mack Manufacturing Company and during the latter part of 1919 or early part of 1920 he interested a party in making a test of the tool in an oil well near Humble, Texas. In 1920, Edwards states, he explained the tester and sketches of it to Simmons, the senior party of this interference. In the fall of 1921 or spring of 1922 a drawing, Ex-

hibit 1, was shown to Seth Evans and he was asked to make a drawing of it that would be somewhat in perspective for advertising purposes. In the early part of 1922 Edwards again met Simmons at Shreveport, and discussed the single string tester with him as well as a double string tester. In discussing the form of packer used Edwards told him about a wood plug packer that could be stripped off of the tool.

The witness Seth Evans coroborates Edwards as to this early activity. Evans, who is an engineer with the Hughes Tool Company, was associated with the Mack Manufacturing Company part of 1920, 1921 and 1922. He testifies that during 1921 Edwards showed him a sketch or drawing that he or some one else had made. He requested Evans to make a more refined drawing which he could use as a basis for a cut to be used in a pamphlet for advertising purposes. Evans describes the tester as follows:

> Q. 14 The question was Mr. Evans state the details of the construction of this tester?
>
> A. The main features of the device comprised a central member which was to be attached to the drill stem and on which was to be carried an annular member on which was mounted a packer, this said annular member was arranged so that it together with the packer could be set into a rat hole so called at the bottom of an oil well, which would then seal off the rat hole from the upper portion of the oil well after which the main or inner member could be

rotated and would release from the outer member and allowing the inner member to be lowered somewhat into the rat hole unclosing openings which would allow the fluid in the rat hole to flow through the inner member into the drill stem and could then either be pumped or would flow under the hydrostatic head of the formation and would then flow to the surface where it could be analyzed for oil contents.

Evans testifies that he is not absolutely certain that Exhibit 1 is the identical drawing given him by Edwards but believes it is the same. He recollects that the details shown on the drawing were the same or very similar to the details of Exhibit 1.

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The Examiner of Interferences found that the testimony of Evans was sufficient to furnish corroboration of possession by Edwards of the invention in issue in 1921. We believe that this finding is correct.

In April and May of 1922 a suit for the receivership of the Mack Manufacturing Company was brought and

a receiver was appointed in September, 1922. In 1924 the Houston Engineers, Inc., was organized by Edwards, Tracy T. Word and Charles W. Markle. The purpose of this company was to exploit Edwards' inventions. After organizing this company threats of suits by the stockholders of the Mack Manufacturing Company were made and in December, 1924 a judgment was obtained against Mack and Edwards. In the latter part of 1924 Edwards states he disclosed the well tester to Mr. Halliburton, the assignee of the Simmons present application (Edwards, page 364, Q. 165). The date is fixed by reference to a letter, Exhibit 36, written to the General Electric Company regarding an automatic drilling device (Edwards, page 365, Q. 167). During the years 1925 and 1926, Edwards testifies, he was working constantly on an educational campaign to teach the public the use of well testers (Edwards, page 379, Q 195). Edwards made many trips through the oil fields and used the vest pocket model, Exhibit 7, to interest the trade in oil well testers. Edwards had obtained a patent on a two-string tester in 1924, patent No. 1,514,585, and he states that he believed his patent covered also a single string tester. In June 15, 1925 an advertisement, Simmons Exhibit 5, disclosing a two string tester was inserted in the Oil Weekly of June 15, 1925. Another advertisement of a two string tester was inserted in the Oil Weekly October 2, 1925. Circulars, Edwards Exhibits 2, 5 and 6, were mailed to various

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rties in the fall of 1925. The drawing, Exhibit 1, was
closed to Mrs. Sell, Mrs. Henry, Mrs. Acebo and Mrs.
rmant in the summer of 1925. In October, 1925
lwards states he had a conversation with Halliburton
l the latter offered to purchase his patent No. 514,585
l any improvement he might make. During the years
25 and 1926, Edwards and his associates Word and
rkle testify, they refrained from actual construction
a testing tool because of the threatened litigation by
ck and the stockholders of the Mack Manufacturing
mpany. A decision denying Mack the right to the
entions of Edwards was handed down June 27, 1927.
tester was ready for operation on July 1, 1927 and
ted. The test is corroborated by the witness Hewit
o actually used the tester on that date.

Simmons filed his application on February 10, 1926.
e do not find from the evidence that Edwards reduced
invention to practice prior to this date, nor did the
miner of interferences so find. The test alleged to
e been made in the Humble oil field in 1919-1920 is
corroborated. The filing of the application upon
ich patent No. 1,514,585 was granted cannot be relied
n for constructive reduction to practice because the
ent does not disclose the invention of the counts.

The party Simmons stands on his filing date, February
1926. At a time just prior to this date Edwards was
diligent in reducing his invention to practice. From
evidence produced Edwards was not in such financial
cumstances that he was unable to pay for filing the
lication. The excuse offered because of the threatened
ts by the stockholders of the Mack Manufacturing
npany is also deemed insufficient. The examiner of
erferences did not consider it necessary to decide
ether Edwards was diligent because he found

that Simmons had derived his invention from Edwards and was therefore not an original inventor. The question of originality will therefore be considered.

Edwards testified that he discussed the invention with Simmons in 1920 and 1922.

Q. 155. Have you ever talked with John T. Simmons about the formation tester involved in this interference?

A. I have.

Q. 156. When was this?

A. The first time I talked with Mr. Simmons was at the old Mack Mfg. Co. plant in Houston, Texas, along in the year 1920. Mr. Simmons came to the plant and we got into discussion about oil field improvements, and I showed him some sketches that I then had of well testers. Mr. Simmons explained to me that had had considerable experience in well drilling. That he had drilled some over at Batson and I believe he told me also in Louisiana. And in our conversation we took up the discussion of well testers. I explained—

BY MR. CLARK: Interrupting the witness—

Q. 157. Have you ever talked with Mr. Simmons about this tester since 1920?

A. I talked with Mr. Simmons—Yes.

Q. 158. Where was this later conversation?

A. Over at Shreveport, La.

Q. 159. When was this conversation at Shreveport,

A. It was in the early part of the year 1922.

Q. 160. Were any specific types of testers discussed?

A. Yes, sir.

Q. 161. Will you please explain what types were discussed?

A. We discussed both the double string and the single string tester and talked about the trouble there would be without circulation. We also in the first conversation talked about the form of valve. I told him that I had tested out under pressure at the old International Marine Iron Works a Cleco valve and told him that I had found that the pressure I put upon the valve with a boiler test pump prevented the valve from working. In the latter discussion at Shreveport we discussed the form of packer among other things and I told him about a wood plug packer that could be stripped off of the tool and that by rotating the stem we would be able to know when there was any danger of sticking and that because of turning the stem I did not believe there would be so much danger of sticking.

Rebuttal testimony was taken on the question of ginality and Simmons, when confronted with Edwards, tified as follows:

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Q. 6. Will you please stand up and look at the gentleman who has just come in and after taking a good look at him as long as you want to, please state whether you are acquainted with that gentleman?

A. I am not acquainted with him.

Q. 7. Please state whether to your knowledge you have ever seen the party Edwards before you saw him just now.

A. Not in my life that I remember of.

Q. 8. Are you the John T. Simmons who filed application Serial No. 87323 filed on or about February 9, 1926, which is involved in this interference?

A. Yes.

By Mr. Richmond: Let the record show that just prior to the asking of Question 6, that the party Charles R. Edwards entered the room where this deposition is being taken.

Q. 9. Did you ever work or drill or work at the drilling of a well or wells in the Batson Oil Field in the State of Texas?

A. No.

Q. 10. Were you ever in the Batson Oil Field, and if so, when and for how long a period of time?

A. I was in Batson one time, one day and one night, in the year 1902 or '03, and at no other time.

Q. 11. Where did you reside during the year 1920, if you remember?

A. On Tarkington's Prairie, Liberty County, Texas.

Q. 12. What business or occupation did you follow during your residence at Tarkington's Prairie in 1920?

A. I was working with cattle; in the cattle business.

Q. 13. During your residence there, were you engaged in any capacity or interested in the production or drilling for oil?

A. The best I remember I was not.

Q. 14. During the year 1920 did you know of, or were you acquainted with a manufacturing company in Houston, Texas, known as the Mack Manufacturing Company?

A. No.

Q. 15. Do you know of your own knowledge whether there was ever a company in the City of Houston, Texas, engaged in the manufacture of oil well tools and equipment and known as the Mack Manufacturing Company?

A. No, not that I remember of.

Q. 16. Did you during the year 1920 at the place of business of the Mack Manufacturing Company in Houston, Texas, discuss with the party Edwards or with any one else oil well testers, either double string or single string testers?

A. No.

Q. 17. Where did you reside during the year 1922, if you remember?

A. In Shreveport, La., most of the year.

Q. 18. In what business or occupation were you engaged during your residence in Shreveport, La., in the year 1922?

A. In the furniture business.

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Q. 19. State where that furniture business was located, if you remember.

A. 113 Texas Avenue, Shreveport, La.

Q. 20. State whether in the early part of the year 1922, or at any time during that year of 1922, you had a conversation with the party Edwards concerning well testing devices, either of the two string or one string or both.

A. I did not.

Q. 21. State whether you have at any time or at any place or under any circumstances ever discussed well testers with the party Charles R. Edwards.

A. Not that I ever remember of.

Q. 22. State whether prior to on or about the 9th day of February, 1926, you ever at any time or at any place discussed well testers of any kind or description with the party Charles R. Edwards.

A. No.

Rebuttal testimony was later taken by Edwards and the witnesses J. D. Pace and R. L. Mayfield were produced. Edwards testified that the Mack Manufacturing Company received the letter, Exhibit B on February 6, 1922 from the Acme Oil and Drill Company of Shreveport, La., and that he came to Shreveport some time later. As he went into the store of the company he met John T. Sim-

mons and they discussed several inventions. In describing the disclosure of the well tester Edwards states:

> I explained at this conversation the well tester, among a number of other inventions that I had and he seemed very much interested in the well tester, his only objection being that it was liable to stick. I explained about the packer—how it could be pulled off and about how I could rotate while making the test so that if cavings did start to fall in the drill stem would slow up in its rotation and he could immediately pull out. I explained the device in detail, using the little model Edwards Exhibit No. 7, and also one or more sketches at that time. I explained all the details of it and told him when he pointed out about sticking of the drill stem that if it had to be I could use the outside string of pipe—that is the two string tester—and circulate. Mr. Pace was present during part of this conversation, which lasted for perhaps thirty minutes or longer.

The witness Pace testified that he had been engaged in the oil business since 1903, and that during the year 1922 he operated an oil well supply store at Shreveport, La., under the name of Acme Oil and Drilling Company, Inc. He testifies that

he has known Edwards since 1920 and Simmons since 1922. He testifies that Edwards and Simmons had a conversation in his store in 1922 as follows in answer to question 14:

> They were in my place of business and Mr. Edwards was showing a little model that he claimed to be an oil tester. Mr. Edwards handed me this little brass trick. I was looking at it and this Slim Simmons was there which all three of us joined in inspecting this little model, about that time I was called away to answer the phone or something and I laid this little model on the hay shelf and when I returned Mr. Simmons had this little model and Mr. Edwards was explaining it to him. Of course, in explaining anything of that kind there was quite a bit of talking, which always goes with new inventions.

Pace made a sketch, Exhibit A, of the model which Edwards had with him. In regard to this tester model Pace testified further:

> Q. 33. Do you recall anything that Simmons said on the time that he, you and Mr. Edwards were examining and discussing the oil well tester model? And if you do remember give the substance of what he said.

A. Well, there was quite a lot of talk, you know, between all three of us at which time Mr. Simmons remarked that if it would test the oil why it would be a very valuable tool in the oil business. I remarked that it would be a humdinger and I would like to own it myself. Of course, I being called away so often I left Edwards and Slim still talking about the model and of course I could not tell what all they said about it.

The witness Mayfield testified that he was a public accountant and secretary-treasurer of the Acme Oil and Drill Company in 1922; that his headquarters was the Acme Oil and Drill Company on Milam street, Shreveport, La.; that he knew Edwards and a man by the name of Slim Simmons in 1922. He also testifies that Slim Simmons came into the store three or four times during 1922, and endeavored to get Mr. Pace to handle a pulling tool that he had.

From the testimony produced we are unable to find that it establishes derivation of the invention by Simmons from Edwards. The witness Pace did not hear more than a part of the.

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conversation between Edwards and Simmons. The sketch which Pace made of the model alleged to have been in Edwards' possession does not show all the essential elements of the invention as recited by the apparatus counts. The additional description of the model and its mode of operation set forth in questions 41 to 44 is not regarded sufficient to show a disclosure of the invention by Edwards to Simmons.

It may also be noted that Pace was a man of seventy-one years of age when he testified. The testimony was given ten years after the alleged conversation took place. It is highly improbable that Pace could, under the circumstances, give any clear description of what Edwards is alleged to have disclosed to Simmons.

The point has been raised by the party Simmons that Edwards failed to prove that the Slim Simmons to whom Edwards alleges he disclosed the invention in issue in 1922 is the same party as John T. Simmons of the present interference. It was pointed out above that John T. Simmons denied that he had ever met Edwards. Neither Pace nor Mayfield has identified Simmons as he was not present when they testified. Effort was made by Edwards to locate him and the counsel for Simmons was called upon to produce him when the testimony was taken. A chain of circumstances is pointed to on pages 7 and 19 of Edwards' brief which counsel for Edwards urges clearly demonstrates that "Slim Simmons" was the same party as John T. Simmons of the present interference. We are not satisfied that this is adequately proven. The party Simmons was produced by his counsel when he took rebuttal testimony and Edwards did not then bring forward any witnesses to identify him as being the Slim Simmons he met in 1922. When Edwards took further testimony later on, Simmons could not be located.

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The party Simmons moved to strike all the testimony of Pace and Mayfield and so much of Edwards' as relates to alleged conversations between the parties Edwards and Simmons which took place in the presence of Mayfield and Pace. It is urged that the testimony is not proper rebuttal and is inadmissible. We believe that this testimony was properly received for reasons stated by the examiner of interferences on page 6 of his decision.

We find from the testimony that Edwards conceived the invention in 1921 but did not reduce the invention to practice prior to Simmons' filing date. We find that Edwards was not diligent in reducing the invention to practice just prior to Simmons' filing date. We find that derivation by Simmons of the invention in issue from Edwards has not been proven.

The decision of the examiner of interferences awarding priority to Edwards is accordingly reversed. Priority is awarded to John T. Simmons, the senior party.

Wm A Kinnon	)	
First Assistant Commissioner	)	
	)	
W. L. Redrow	)	Board
Examiner-in-Chief	)	of
	)	Appeals
T. P. Edinburg	)	
Examiner-in-Chief	)	
May 16, 1933	)	

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Appeal No. 8322 Paper No. 119
8422

Decision

Appeal Nos. 8322-8422 TM

IN THE UNITED STATES PATENT OFFICE

BEFORE THE BOARD OF APPEALS

Edwards vs. Simmons

* * *

Patent Interference No. 59,515 between the applications of Charles R. Edwards filed August 24, 1928, Serial No. 301,762 and John T. Simmons filed February 10, 1926, Serial No. 87,323. Testing Device for Wells.

Messrs. Hardway & Cathey, Messrs. Foster & Codier, and Messrs. Jesse R. Stone and Lester B Clark for Edwards.

Messrs. Lyon & Lyon and Messrs. Mason & Mason for Simmons.

[Written in margin]: Noted TM

The party Edwards has filed a petition for reconsideration of our prior decision in which award of priority was made to the party Simmons. The party Simmons has also filed a statement in reply to the petition of Edwards. A number of points have been raised by the party Edwards and they will be considered in the order set forth in the petition.

POINT 1.

It is argued that the testimony taken shows that the device of Simmons is inoperative. During the motion

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period Edwards filed a motion to dissolve on the ground that Simmons showed an inoperative device. The Examiner of Interferences held that the device was operative. (Paper No. 27; p. 5). Edwards contends that when pressure is applied to the drill stem there will be so much friction between the body or packer 4 and the bushing 19 in the Simmons' device that these parts will rotate together even though the packer is in the rat hole. Hence he argues that it would be impossible to rotate one of these parts with respect to the other so as to open the fluid admission passage. It has been pointed out in the record that if some lubricant be used between these parts the friction will be largely overcome. If such lubricant need be used any mechanic would exercise no invention in using it. The testimony shows that lubricant was used by Simmons and when used the device was formed to operate satisfactorily. (Simmons' record, p. 11, XQ. 237).

In the Simmons' record testimony was given by Stoddard and Halliburton that tests were successfully made with Simmons' Exhibit 1. (pages 77, 78, 105 and 129 to 132 of Simmons' record). Stoddard was asked his opinion of the operativeness of Simmons' Exhibit 1 and stated that he regarded it as being operative. (Simmons' record, p. 82).

Edwards refers to Exhibit No. 45, which is the log of a well where a test is alleged to have been made, and he states that this log does not show any test. The log describes the character of the formations encountered in the well. The semi-daily reports set forth what was done under the direction of the driller at the well. The report would not be expected to show the work done by an independent

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contractor. The test run at the well was made under the direction of Simmons and not the driller.

Edwards submitted opinion testimony of Evans and Edwards that the Simmons' device would be inoperative but there were no actual tests made by them to demonstrate such inoperativeness. There has been no evidence submitted that the Simmons' disclosure is inoperative in principle or in substance. Hence we do not find that the evidence discloses that the Simmons's device is inoperative.

POINT 2.

Edwards points to the fact that the assignee of Simmons later adopted a construction which involves a stop cock and gear and that this shows that the Simmons' original construction was abandoned as being inoperative. There seems to be no reason to make such an inference. Mechanical changes are continuously made in devices in commercial use but this does not prove that a prior device used is inoperative. The successful operation of the original device was testified to by Stoddard. (Simmons R. 76-82).

POINT 3.

Edwards urges that we review again his contention that Simmons' application as originally filed does not support the counts of the interference. As this has been previously considered it is not necessary to amplify it further. The matter is so fully discussed in the brief of Simmons, pages 118-122, that reference is made to it. It is

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pointed out therein in detail how the counts are fully supported by the Simmons' application and the party Edwards has not specifically pointed out why the counts do not apply to it. It is our view that they are clearly readable on Simmons' original disclosure.

POINT 4.

In our decision on the motion to dissolve we pointed out in great details why we regarded that the Edwards' patent No. 1,514,585 did not disclose the invention of the present counts. In our decision on priority we also repeated this holding. There is nothing in the testimony that has changed our view. In regard to the Court decision referred to the reply statement of Simmons points out that the Court held that the patent disclosed a two string testing tool.

The fact that Edwards and Stoddard applied the counts to the patent does not have any particular weight in ascertaining what the patent discloses.

POINT 5.

In our prior decision we found and so stated that Edwards was not diligent at the time Simmons entered the field and that the excuse offered for not being diligent was insufficient. From the record it is obvious that Edwards was not making any effort to reduce the invention to practice at the time Simmons entered the field. The excuse offered was that suits were filed against him on a contract with respect to certain of his patent rights. It appears that the suits were based on a contract, Exhibit

109, dated Jan. 3, 1921 between him and J. O. Mack. This contract does not mention any invention of a one-string tester or a tester which would embody the counts of the interference. It apparently did not prevent Edwards from developing a one-string tester. Hence the excuse offered was deemed insufficient.

POINT 6.

The question whether new matter has been inserted in the Simmons' specification has been disposed of above. The original disclosure is regarded as forming sufficient basis for the counts and no new matter has been inserted.

POINT 7.

In our prior decision we considered all of the testimony as to reduction to practice by Edwards prior to the filing date of Simmons. The test alleged to have been made in an oil well near Humble, Texas was not corroborated. There were no other tests proven prior to the filing date of Simmons.

POINT 8.

The testimony as to diligence was fully considered by us. The activity of Edwards prior to Simmons' filing date was in the exploitation of the two-string tester of his prior patent. This cannot be taken as establishing diligence in the reduction of a single string tester. Furthermore, the circulars which were mailed to the

trade after Simmons' filing date related to the two-string tester.

POINT 9.

It was pointed out in our decision that the threatened suits by the stockholders of the Mack Mfg. Co. were regarded insufficient to excuse activity in the reducing a one-string tester to practice.

POINTS 10-13.

These points were treated so fully in our prior decision that we find no reason to add anything further to what was formerly stated. As to points 12 and 13 attention is directed to page 8 of the reply statement of Simmons.

The party Edwards has filed a motion to extend the appeal period thirty days. As the time for filing appeal is fixed by Rule 149 the motion is denied.

We have carefully noted all of the points raised by the party Simmons. In our prior decision we did not discuss some of the points raised as fully as they should have been discussed. A somewhat amplified statement has therefore been made herein in reconsidering the case. In view of the fact that our prior decision was incomplete in some respects the petition for reconsideration is granted. We have carefully reviewed the case but find no reason for arriving at any different conclusion from that arrived at in our prior decision in awarding priority to Simmons.

The petition for reconsideration is granted.

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The limit of appeal runs from the date of the present decision.

Wm A Kinnon First Assistant Commissioner	)	
W. L. Redrow Examiner-in-Chief	)	Board of Appeals
T. P. Edinburg Examiner-in-Chief	)	

June 26, 1933

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[Sheet..........]

1	Jan 30 1930	Declarations Statements etc. Mar 10 1930	
2	Feb 19/30	Statement of Simmons	
3	Feb 27/30	Statement of Edwards	
4	Mar. 12/30	Notice of appointment of asso. attys	
5	" 20/30	Testimony set. F. H. Oct. 7/30.	
6	Apr 18/30	Motion of Simmons to Add Counts & Amdt	

7.	" 19 "	Motion to Diss obj Edwards
8	" 23 "	Comm'r Order (set 122: and 109 if Amended)
9	" 25 "	Memo for Simmons Rule 109)
10	May 1/30	Motion of Simmons to advance hearing
11	May 5/30	Notice of hearing by Law Examiner
12	" 8 "	Brief for Edwards
13	" 9 "	Letter of Law Ex'r
14	" 22 "	Motion by Edwards to postpon hrg.
15	" " "	Notice by Edwards
16	" 23 "	Protest by Simmons
17	" 24 "	Letter of Law Exr
18	" " "	Brief for Edwards
19	June 2/30	Brief for Simmons
20	" " "	" " Edwards
21	" " "	Letter of Law Exr.
22	" 5 "	Brief for Edwards
23	" 6/30	Affidavit for Simmons
24	" 11/30	Brief for Edwards
25	" 11/30	Protest by Edwards.
26	" 11/30	Appo to motion to amend by Edwards
27	June 24/30	Decision by Exr. of Intfs. L. A. July 24/30.
28	July 7/30	Appeal To The BOARD OF APPEALS Simmons
29	" 23/30	Appeal To The BOARD OF APPEALS Edwards.
30	Aug 7 1930	Letter

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[Sheet................]

31	Aug.	13,	1930	Protest by Simmons re Edwards Appeal.
32	Nov.	10,	1930	Hearing by Board set for Jan. 27, '31. 9:30 A. M.
33	Nov.	28,	1930	Supp. Motion to Dissolve by Edwards.
34	Dec.	2,	1930	Protest by Simmons.
35	Dec.	4,	1930	Edwards Motion to Dissolve dismissed.
36	Dec.	3,	1930	Memo. for Edwards.
37	Jan.	5,	1931	Notice by Edwards.
38	Jan.	27,	1931	Brief for Simmons with Appendix.
39	Jan.	27,	1931	Brief for Edwards.
40	Feb.	17,	1931	Decision by Board.
41	Feb.	24,	1931	Testimony reset. F. H. Aug. 11, 1931.
42	Apr.	13,	1931	Motion by Edwards to extend time for testimony.
43	Apr.	14,	1931	Hearing on Motion by Edwards April 24, 1931.
44	Apr.	23,	1931	Affidavit, etc., for Edwards.
45	Apr.	24,	1931	Brief for Simmons.
46	Apr.	25,	1931	Motion granted as indicated. Times extended. F. H. Sept. 22, '31.

47	May 19, 1931	Notice of appointment of associate attorneys.
48	May 26, 1931	Petition, Simmons, for access to and copies of Edwards Exhibits with aff. Rule 75.
49	May 27, 1931	Comms. Order. (Edwards fiven 10 days to show cause why Petition should not be granted.
50	Jun. 3, 1931	Motion by Edwards to extend times for testimony.
51	Jun. 3, 1931	Affidavit for Simmons, opposing motions.
52	June. 5, 1931	Edwards motion to extend times not approved. L. A. June 25, '31
53	Jun. 8, 1931	Stipulation to extend times for testimony etc.,
54	Jun. 8, 1931	Letter from Attorneys for Edwards.
55	Jun. 9, 1931	Dec'n June 5, '31 vacated. Test'y reset. F. H. Oct. 20, '31
56	Jun. 1931	Comms. Decision (Pet. Simmons for access granted) see paper #48
57	Jun. 20, 1931	Notice of Comm'rs. decision on petition.
58	July 25, 1931	Testimony for Edwards. (2volumes)
59	Aug. 5, 1931	Testimony for Simmons
60	Aug. 18, 1931	Rebuttal testimony for Edwards.

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[Sheet................].

91	June	29/32	Rebuttal TESTIMONY FOR Edwards
92	"	29 "	EXHIBITS FOR Edwards (Section 24)
93	"	29 "	Letter to "
94	July	5/32.	Letter from Attys. for Edwards, withdrawing motions.
95	"	19 "	PRINTED RECORD FOR Simmons (Vol. 2) (31 copies)
96	"	19 "	Letter to "
97	"	20 "	PRINTED RECORD FOR Edwards (Rebuttal) (31 copies)
98	"	20 "	Letter to "
99	Aug.	8/32.	Motion by Simmons to suppress testimony.
100	"	8/32.	Opposition by Edwards to motion to suppress.
101	"	10 "	Letter to Parties.
102	Aug.	23/32.	Motion by Simmons to strike out testimony.

103 " 26 " BRIEFS FOR Simmons (6 copies)

104 " 26 " BRIEFS FOR Edwards (6 typewritten copies)

105 " 26 Briefs for Edwards on motion (6 typewritten copies)

106 Dec. 21/32. Decided favor Edwards. L. A. Jan. 21/33.

107 Jan. 13/33 Appeal To The BOARD OF AP-PEALS Simmons

108 " 18 " Hearing by Board set for April 28/33

109 " 20/33 Proof of service in re appeal of Simmons (already furnished)

110 " 21/33 Appeal To The BOARD OF AP-PEALS Edwards (No right of Appeal)

[In margin]: 8322

111 Feb. 1/33 Decision by Board on Edward's Appeal (Dismissed)

112 Mar. 28/33 Brief for Simmons (6 copies) Proof of Service

113 Apr. 18/33 Brief for Edwards (6 copies) Pr. of Service

114 May 16/33 Decision by Board. (Reversed)

115 June 1 " Petition for Reconsideration by Edwards

116	" 16/33	Reply by Simmons to Edwards' Pe for Recon	
117	" 20/33	Motion by Edwards for Extension Time to file Appeal	
118	" 22/33	Letter by Edwards.	
119	" 26/33	Decision by Board on Pet. for Reco sideration (Granted)	
120		Decision Noted Div. 38	
121—	Nov. 23/33	Record (Exhibits for Simmons (turned (See letter)	
122—	Nov. 25/33	Record (Exhibits for Edwards (turned. (See receipt)	

59515

[Stamped on back]: Assembled by M H. Revis by.......................... Letter No. 136221 Date..........

No. D-56-Eq Halliburton et al vs. Honolulu Oil Co Plfs EXHIBIT No. 3 Filed 11/11 1935 R. S. ZI MERMAN, Clerk, By .... Deputy Clerk.

[PLAINTIFFS' EXHIBIT No. 4-A.]

390

DEPARTMENT OF COMMERCE
United States Patent Office

To all persons to whom these presents shall come,
Greeting:

THIS IS TO CERTIFY that the annexed is a true copy from the records of this office of Papers 1 and 39, in the matter of

Interference Number 55,940,

Williams vs Allen vs Powell vs Lewis vs Erickson vs Johnson vs Cox vs Simmons
Subject Matter:–
Well Tester.

In Testimony Whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this twenty-ninth day of October , in the year of our Lord one thousand nine hundred and thirty-five and of the Independence of the United States of America the one hundred and sixtieth.

[Seal]

Attest:

C. W. Sutton
Acting Chief of Division.

Conway P. Coe
Commissioner of Patents.

Intf A

Letter No.

[Stamped]: Intf. Number 55940 Intf. Declared Oct 10 1927 Statements Due Nov 14 1927

Room No. 145

2–251

Address only ———

The Commissioner of Patents
Washington, D. C."

UNITED STATES
DEPARTMENT OF ~~THE INTERIOR~~ COMMERCE
PATENT OFFICE
Washington, D. C.

Oct 5-1927, 192

EXAMINER OF INTERFERENCES:

An interference is found to exist between the following cases, and in respect to the invention therein specified, to wit:

CASES

~~1. Name. Charles L. Williams,~~

~~Post office address 969 B Union Trust Bldg. Pittsburgh, Pa.~~

~~Title Apparatus for Testing Wells~~

~~Filed Aug. 27, 1927, Ser. No. 215,830~~
~~Pat'd No.~~

~~Division or continuation of~~

~~Attorney Archworth Martin of 513 Union Trust Bldg., Pittsburgh, Pa.~~

~~Associate Att'y of~~

~~Assignee of~~

~~2. Name Otto J. Allen~~

~~Post office address 409 Sames Moore Bldg., Laredo, Webb County, Texas.~~

~~Title Well Tester,~~

~~Filed July 25, 1927 Ser. No. 208,150~~
~~Pat'd No.~~

~~Devision or continuation of~~

Attorney Hardway & Cathey, of 428 Bankers Mortgage Bldg., Houston, Texas.

Associate Att'y of

Assignee of

~~(7) 3. Name Conrad T. Nietzel,~~

~~Post office address 2236 Live Oak St., Dallas, Texas.~~

~~Title Well Testing Tools~~

~~Filed June 28, 1927 Ser. No. 202,150 (Reissue) of Pat. No. 1625140 granted Apr. 19/27 on appln. No. 167910, filed February 14, 1927 No~~

~~Division of continuation of~~

~~Attorney Jack A. Schley, of 904 Allen Bldg., Dallas, Texas~~

~~Associate Att'y Alfred T. Gage, of 3015 Legation St., Washington, D. C.~~

~~Assignee of~~

INVENTION

Intf. No. 55941 Consolidated herewith

55940—1

~~(3)~~ ~~4.~~ ~~Name: Ernest Powell~~

~~Post Office Address: Box 56A, Route 1, Va~~
~~Ormy~~
~~Orma, Texas.~~

~~Title: Well Tester.~~

~~Filed: May 10, 1927, Ser. No. 190,16~~
~~Pat'd No.~~

~~Attorney: Jesse R. Stone, of C/o Andrews~~
~~Streetman, Logue & Mobley~~
~~Union Nat. Bank Bldg., Hous-~~
~~ton, Texas.~~

Associate Att'y:

Assignee:

(1) ~~5.~~ Name: Guy V. Lewis,

Post Office Address: Robert E. Lee Hotel
Laredo, Texas.,

Title Well Testing Device

Filed May 6, 1927, Ser. No. 189,294,
Pat'd. No.

Attorney: Jesse R. Stone; of Andrews
Streetman, Logue & Mobley
Union National Bank Bldg
Houston, Texas.

Associate Att'y:

Assignee:

~~(5)~~ ~~6.~~ ~~Name:~~ ~~David~~ ~~Erickson,~~

k

~~Post Office Address:~~ ~~Erickson Pattern Words,~~
~~508 Ohio Ave Wichita~~
~~Falls, Texas.~~

~~Title:~~ ~~Oil Well Packers.~~

~~Filed. April 11, 1927; Ser. No. 182,817,~~
~~Pat'd.~~ ~~No.~~

~~Attorney:~~ ~~Watson, Coit, Morse and Grindle,~~
~~of Mather Bldg Washington~~
~~D. C.~~

~~Associate Att'y:~~

~~Assignee:~~

55940—2

~~(6)~~ ~~8.~~ ~~Name: Edgar Clinton Johnston,~~

~~Post. Office Address: El Dorado, Union C~~
~~Arkansas,~~

~~Title: Well Formation Testing Device~~

~~Filed: Mar. 23, 1927, Ser. No. 177,719,~~
~~Pat'd. No~~

~~Attorney: Clarence A. O'Brien, of Sec. Sa~~
~~& Coml Bank Bldg., Washin~~
~~ton, D. C.~~

~~Associate Att'y:~~

~~Assignee: Johnston Formation Testing Corp~~
~~ration, of El Dorado, Arkans~~

(2)
~~7~~ ~~(8)~~ ~~9.~~ Name: Ernest H. Cox,

Post Office Address: Duncan, Stephens C
Oklahoma.,

Title: Oil Well Testing Device

Filed: Feb. 4, 1927, Ser. No. 165.9
Pat'd. No

Attorney: Eccleston & Eccleston of Loan
Trust Bldg., Washington, D.

Associate Att'y:

Assignee:

(3)

8 ~~(9) 10.~~ Name: John T. Simmons,

Post Office Address: P. O. Box 1411, El Dorado, Arkansas

Title: Method and Apparatus for Testing the Productivity of Formations Encountered in Wells

Filed: Feb. 10, 1926, Ser. No. 87,323, Pat'd. No.

Attorney: Lyon & Lyon, of 708 National City Bank Bldg., Los Angeles, Calif.

Associate Att'y: J. M. Mason, McGill Bldg., Washington, D. C.

Assignee: Erle P. Halliburton, of Los Angeles, Calif.

Intf. No. 55941 Consolidated herewith

INVENTION

[In margin]: Dissolved See Paper No 39

~~1. A method of testing the productivity of a formation encountered in a well containing drilling fluid, which includes lowering a sample chamber into the well through the drilling fluid to the formation to be tested, the chamber being closed against the entrance of fluid from the well during the lowering operation, sealing off the well above the formation to exclude the drilling fluid from the formation, opening the chamber to permit cognate fluid from the formation to enter the chamber, closing the chamber against the entrance of fluid from the well,~~

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Sheet 4.

~~releasing the seal and removing the chamber so closed to withdraw an entrapped sample of fluid from below the point at which the well was sealed off.~~

~~2.~~ 1. A method of testing the productivity of a formation encountered in a well containing drilling fluid, which includes lowering an empty string of pipe into the well through the drilling fluid to adjacent the formation, the pipe carrying a packer and having a valved inlet at its lower end which is closed while the pipe is being lowered, setting the packer above the formation to seal off the drilling fluid from the formation, opening the valved inlet after the packer is set to permit cognate fluid from the formation to enter the pipe, closing the valved inlet against the entrance of fluid from the well by movement of the pipe, raising the pipe so closed to remove an entrapped sample and the packer from the well.

~~3.~~ 2 A method of testing the productivity of a formation encountered in a well containing drilling fluid involving the insertion of only a single string of pipe into the well to make a test, which includes lowering a test string into the well through the drilling fluid with a packer carried by the string and a valved inlet at the lower end of the string closed against the entrance of fluid from the well, setting the packer above the formation and opening the valve to permit cognate fluid from the formation to enter the inlet, closing the valve to prevent the subsequent entrance of fluid from the well

through the inlet and releasing the packer, and raising the test string with the inlet closed against the entrance of fluid from the well to remove an entrapped sample and the packer.

~~4~~ 3 Apparatus for testing a well comprising a string of pipe to be lowered into a well having an inlet at its lower end and carrying a packing for sealing the well above the inlet, and a valve for the inlet positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

~~5~~ 4 Apparatus for testing a well comprising a string or pipe to be lowered into the well, a packer carried by the pipe and means at the lower end of the pipe to receive a sample from the well including an inlet and a valve for controlling the inlet, the valve being positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

~~6~~ 5 Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, which includes an empty string of pipe to be lowered into the well to adjacent the formation to be tested, a packer carried by the pipe, means at the lower end of the pipe to receive a sample from the formation including an inlet opening into the pipe and a valve structure for controlling the inlet, the valve structure including a plurality of relatively movable parts one of which is secured to the pipe and another of which is connected to the packer.

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Sheet 5.

~~7.~~ 6 Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, which includes a single empty string of pipe to be lowered into the well to adjacent the formation to be tested, means lowered into the well by said string of pipe for sealing off the drilling fluid from the formation to be tested, means at the lower end of said string of pipe to receive a sample from the formation including an inlet opening into said pipe and a valve structure for controlling the inlet, said valve structure including a part connected to said sealing means and a part connected to said pipe.

~~8.~~ 7 Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, comprising a single empty string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to be tested, a packer lowered into the well by said string of pipe for sealing off the drilling fluid from the formation to be tested, means at the lower end of said string of pipe to receive fluid from said formation including an inlet opening into said pipe below said packer and a valve structure for controlling the inlet, said valve structure having a relatively stationary part connected to the packer and a relatively movable part connected to the pipe.

~~9.~~ 8 Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, comprising a single empty string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to be tested, a packer carried by the pipe for sealing off the well above the formation, an inlet below the packer opening into the pipe, and a valve for the in-

let, the setting of the packer and the operation of the valve being positively controlled by movement of the pipe.

[In margin]: Dissolved See Paper 39

~~10. Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, comprising a string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to be tested, means carried by the string of pipe to permit the flow of cognate fluid from the formation into the pipe, said means including relatively movable parts having passages adapted to be brought into alignment to allow the fluid to flow into the pipe and brought out of alignment to retain the fluid in the pipe, and a packer mounted on one of said parts for sealing off the drilling fluid from the formation while the passages are aligned.~~

~~11.~~ 9 Apparatus for testing the productivity of a formation in a well containing drilling fluid, comprising a string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to receive a fluid sample therefrom and to be raised out of the well to remove the entrapped sample, said pipe being closed against the flow of drilling fluid as the pipe is lowered into the well, a packer carried by the pipe as the pipe is lowered into and removed from the well and adapted to be seated by manipulation of the pipe to seal off the well above the formation, an inlet to the pipe communicating with the well below the point at which the packer seals off the well, and means for controlling the inlet to permit fluid from the formation to enter the pipe while the packer is set and to prevent fluid from entering the pipe after the packer is released and the pipe is being raised out of the well.

~~12.~~ 10 Apparatus for testing a well containing drilling fluid

55940—5

Sheet No. 6

comprising a single string of pipe to be lowered into th well through the drilling fluid, said pipe being clos against the entrance of the drilling fluid, means at th lower end of the pipe for receiving a sample includin an inlet opening into the pipe, means carried by the pi for sealing the well above the inlet, and a valve for th inlet that may be positively opened and closed by mov ment of the pipe while the well is sealed above the inlet.

For counts 11 and 12 see Intf. No. 55941

The relation of the counts of the interference to t claims is as follows:

	Counts	Williams	Allen	Neitzel	Powell	Lewis	Erickson	Johnston	Cox
	~~1~~	~~15~~	~~13~~	~~18~~	~~8~~	~~10~~	~~16~~	~~6~~	~~7~~
1	~~2~~	16	14	19	9	11	17	7	8
2	~~3~~	17	15	20	10	12	18	8	9
3	~~4~~	18	16	21	11	13	19	9	10
4	~~5~~	19	17	22	12	14	20	10	11
5	~~6~~	20	20	25	15	17	23	13	14
6	~~7~~	21	21	26	16	18	24	14	15
7	~~8~~	22	22	27	17	19	25	15	16
8	~~9~~	23	23	28	18	20	26	16	17
	~~10~~	~~24~~	~~24~~	~~29~~	~~19~~	~~21~~	~~27~~	~~17~~	~~18~~
9	~~11~~	25	25	30	20	22	28	18	19
10	~~12~~	26	26	31	21	23	29	19	20

(Counts compared)

B.

Respectfully,

C. F. Krafft

Examiner, Division 38

55940-

[Stamped]: Docket Clerk Nov 1 1928 Copy Mailed

Hearing: July 27, 1928. MSP

In the United States Patent Office

Williams v. Allen v. Powell v. Lewis v. Erickson v. Johnston v. Cox v. Simmons.

Patent Interference No. 55,940.

Motions to Dissolve.

Well Tester.

Application of Charles L. Williams filed Aug. 27, 1927, No. 215,839.

Application of Otto J. Allen filed July 25, 1927, No. 208,150.

Application of Ernest Powell filed May 10, 1927, No. 190,166.

Application of Guy V. Lewis filed May 6, 1927, No. 189,294.

Application of David Erickson filed Apr. 11, 1927, No. 182,817.

Application of Edgar Clinton Johnston filed Mar. 23, 1927. No. 177,719.

Application of Ernest H. Cox filed Feb. 4, 1927, No. 165,984.

Application of John T. Simmons filed Feb. 10, 1926, No. 87,323.

Mr. Archworth Martin for Williams.

Messrs. Hardway & Cathey for Allen.

Mr. Jesse R. Stone for Powell.

Mr. Jesse R. Stone for Lewis.

Messrs. Watson, Coit, Morse & Grindle for Erickson.

Mr. Clarence A. O'Brien and Mr. Edwin E. Huffman for Johnston.

Messrs. Eccleston & Eccleston for Cox.

Messrs. Lyon & Lyon and Messrs. Mason & Mason for Simmons.

The party Erickson moves to dissolve. His first motion alleged that counts 1, 3 and 10 are anticipated by the patents to:

Edwards.	No. 1,514,585	Nov. 4, 1924
Cooper.	No. 1,000,583	Aug. 15, 1911

His second motion rests on the following grounds:

A. Now comes the party Erickson, by his attorneys and moves that this interference be dissolved as to Counts

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1, 2, 3, 6, 7, 8 and 11 as failing to properly define invention as required by Sec. 4888 of the Revised Statutes.

B. It is further moved that this interference be dissolved as to all of the counts of the issue, as to the party Erickson, on the ground that the party Erickson cannot make the claims as drawn.

C. In addition, if these counts are construed to read upon Erickson, then in the same manner they read upon the prior patent to Cox, No. 1,347,534, July 27, 1920.

His third motion requests dissolution as to counts 2, 4 to 9, inclusive, 11 and 12 in view of the Edwards patent above cited, particularly as supplemented by the patent to Hemme, No. 976,737, November 22, 1910.

and

The parties Lewis & Johnston move to dissolve in view of the Edwards and Cooper patents cited by Erickson.

The issue includes ten counts, of which the first three are directed to a method of testing and the remainder relate to the testing apparatus. They appear in the declaration and are not reproduced.

The first motion by Erickson submits the patents to Cooper and Edwards for anticipation of counts 1, 3 and 10. The party Simmons contends that these patents are inoperative and supports the statement by affidavits. The affidavits have been considered so far only as they appear to traverse a mode or capability of operation of a reference. Roller v. Goodwin, 1921 C. D. 11. The patent to Edwards is not so inoperative that it cannot be used as a reference. Commercial operativeness is not required. Count 1 says nothing about the size of or depth of the well, or any conditions which would make it impossible to use the Edwards device in the manner described in the patent. The sample is merely a portion of the "cognate" fluid of the formation which may be oil, or gas or other fluid from the stratum to be tested. The sample chamber is the end of a pipe carrying the testing device and may

2 55940—28 ~~55 122~~

extend to the top of the well. There are no limits specified for the size of the chamber or the amount of the sample. There is no doubt that when stem 8 is in the position of Fig. 2 a quantity of oil, gas or other fluid may pass under pressure through the perforated section of the stem 8 of Edwards' testing device and be examined as a sample of the quality and quantity of flow of the fluid. The perforated end of the stem 8 obviously may be drawn up into the sleeve 7 and the two withdrawn from drill pipe 1 before withdrawal of the drill pipe. Apparently the threaded end of stem 8 could be reengaged with the threaded end of sleeve 7 without dislodging sleeve 7 until it was necessary to draw up both the stem 8 and sleeve 7. The last paragraph of Edwards' specification states how the apparatus may be finally withdrawn from the well and does not necessarily mean that the perforated end of the stem 8 must be below sleeve 7 when the packer has been released. Sealing off the well above the formation is accomplished by the packer 5 and releasing the seal and removing the chamber are obvious steps in the use of the Edwards device. If the chamber is closed by the lower end of stem 8 engaging sleeve 7; which appears to be a capability of operation inherent in the apparatus, sleeve 7 and stem 8 will be withdrawn together by an upward pull on stem 8 and will withdraw whatever fluid may be entrapped in the chamber, the fluid coming from below the point at which the well was sealed off.

Count 1 is held unpatentable over the Edwards patent. The Edwards patent does not anticipate count 3 since it employs two strings of pipe. Nor does it anticipate count 10 since the packer 5 which seals off the drilling fluid from the formation is not mounted on one of the two relatively movable parts such as sleeve 7 and stem 8.

3. 55940 9 ~~55 123~~

The patent to Cooper does not discl[illegible] he method of count 1 since the testing is by pumping or bailing and not by withdrawal of a closed chamber with entrapped sample of fluid. The patent is not a sufficient reference for count 3 since two strings of pipe are necessary. The patent is a substantial anticipation of the apparatus claimed in count 10 which is not restricted to a use such as set forth in the method of count 1. It is immaterial whether valve sleeve 23 has a passage in it or not since it may uncover the opening 24 in pipe 2 by bringing another opening in alinement with opening 24 as an obvious mechanical equivalent. The count does not call for a closed chamber or the withdrawal of a closed chamber with an entrapped sample.

In the second motion by Erickson counts 1, 2, 3 and 11 are alleged to be functional because each of them contains the function of withdrawing an "entrapped sample", and counts 6, 7 and 8 are alleged to be functional because each of them contains the functional statement "to receive" a sample or fluid. Count 3 is further alleged not to comply with the statute in that it does not set forth a proper method claim.

Count 1 in line 3 refers to a sample chamber and to opening the chamber to permit cognate fluid from the formation to enter the chamber and further refers to closing the chamber. The method of count 1 is not limited to any specific mode of entrapping a sample but it is evident that the closed chamber is to retain a sample entrapped in some way. No specific reference in the count to a device for entrapping is necessary and entrapping may be incidental to closing the chamber. It does not appear to be a vital matter that no distinct step of en-

4 55940 ‡ 10 ~~55 124~~

trapping is recited in the count. Similar remarks apply to counts 2 and 3. In the apparatus of count 11 some means for entrapping a fluid sample must be necessarily implied by the reference to removing the entrapped sample if the means for controlling the inlet to the pipe is inadequate.

The limitation in count 3 to the use of only a single string of pipe cannot be disregarded. Smithey v. Myers 1927 C. D. 165.

Counts 6, 7 and 8 contain sufficient structure to "re ceive" a sample and if "receive" necessarily implie retaining, means at the lower end of the pipe to receiv a sample also includes means to receive and to retain.

The motion does not state in the explanation of groun B that counts 1, 2, 3 and 11 as drawn are not readabl on the party Erickson and discussion of these counts i unnecessary.

Counts 4, 5 and 9 do not require direct actuation o the valve for the inlet by contact with the pipe. They ca for positive control of the valve by movement of the pipe It is clear that valve 23 of Erickson is positively controlle by movement of the pipe which causes lug 25 of the valv to contact bushing 36 to open the valve, and there ca be no closing of the valve until the pipe has moved upwar enough to release lug 25 from the bushing 36. The move ment of the pipe positively controls the valve.

As to counts 4, 5 and 12 the motion asserts that n movement of the valve 23 of Erickson can be accomplishe while the packer is seated. In the downward movemen of the pipe from the position in Fig. 1 to that in Fig. the packer is compressed before the valve is opened an the packer remains compressed to some extent as the pip begins its upward movement. The opening and closing o the inlet is therefore caused while the packer is seate

5. 55940. 11 5 55 125

Counts 6, 7 and 8 can be made by Erickson. A valve structure is not limited to a valve per se, but may comprise a movable valve and an element cooperating therewith. The valve structure of Erickson may include collar 36 as well as valve 23.

Count 10 is not clearly readable on Erickson's disclosure. There are no relatively movable parts having passages adapted to be brought into alignment to allow fluid to flow into the pipe and brought out of alignment to retain fluid in the pipe as in the device of Simmons. The passages in pipes 12 and 33 are permanently in axial alignment.

It is not apparent that the patent to Cox is a satisfactory reference for any count except count 1. The glass plate 13a at the lower end of the rubber packer 10 is not a valve, and the sample is received in an inner tube or hose not in a pipe which carries the packer. Other differences are obvious. Count 1 does not require the employment of the method in a deep well wherein the shock of a drop would be destructive to the pipe, nor is it necessary that the sample should be from a large area of the formation. The packer, if of proper proportionate size, would apparently expand sufficiently to seal the well above the formation to be tested. The check valve 15 is designed to hold sample liquid in the interior of nipple 9 and hose 13. If the valve shown is not suitable for the purpose any suitable construction may be used. As the pipe 1 is raised any pressure of fluid in nipple 9 through perforations 8 upward against valve 15 would not necessarily be so unbalanced by downward pressure above valve 15 that the valve would stay open and the sample in pipe 13 be made useless by contamination.

The third motion by Erickson relies upon the patent

6 55940 12 ~~55~~ ~~126~~

to Edwards No. 1,514,585 supplemented by the patent to Hemme No. 976,737 to meet counts 2, 4 to 9 inclusive, 11 and 12. The latter patent is for a packer not a tester. It was cited merely to show that it is old to provide a valve positively opened and closed by movement of the pipe.

Modifications of the Edwards device suggested in the motion are not clearly taught by other patents and are not obvious. Both pipes 1 and 8 are essential. The pipe 1 carries the packer but movements of pipe 1 do not control the opening and closing of an inlet to pipe 1.

The motions by Lewis and Johnston deny patentability to the counts in view of the patents to Edwards & Cooper discussed above and further discussion of the patents is unnecessary. There is no suggestion in the Edwards patent that sleeve 7 could be made to engage the upper end of a "rat hole" or the walls of the well.

The motion by Johnston further contends that Johnston cannot make count 10 if the limitation as to valve details distinguishes from the Edwards patent. Count 10 is not fully readable on the Johnston disclosure since there are no relatively moveable parts having passages adapted to be brought into alignment and brought out of alignment. The passages 4 and 5 are permanently in alignment.

The motions by Erickson are denied as to all counts except counts 1 and 10 and are granted as to these counts.

The motion by Lewis is also denied as to all counts except count 1 and is granted as to this count.

The motion by Johnston is granted as to counts 1 and 10 and is denied as to other counts.

A limit of appeal is set to expire November 21, 1928. November 1, 1928.

J. P. Disney
Law Examiner.

7 · 55940 13 ~~55 127~~

[Stamped on back]: Assembled by M. H. Revised by .... Letter No. 136221 Date

No. D-56-Eq. Halliburton et al vs. Honolulu Oil Corp. Plfs Exhibit No. 4-A Filed 11/11 1935 R. S. ZIMMERMAN, Clerk By Cross, Deputy Clerk.

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE

To all persons to whom these presents shall come, Greeting:

THIS IS TO CERTIFY that the annexed is a true copy from the records of this office of Papers 1 and 40, in the matter of

Interference Number 55,941,

Allen vs Williams vs Powell vs Lewis vs Erickson vs Johnston vs Cox vs Simmons,

Subject Matter:–
Well Tester.

In Testimony Whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this twenty-ninth day of October, in the year of our Lord one thousand nine hundred and thirty-five and of the Independence of the United States of America the one hundred and sixtieth.

[Seal]

Conway P. Coe
Commissioner of Patents.

Attest:

C. W. Sutton
Acting Chief of Division.

Bryant: MEB

2–251

Room No. 145 Intf I

Address only
The Commissioner of Patents
Washington, D. C.

Letter No.

UNITED STATES
DEPARTMENT OF ~~THE INTERIOR~~ COMMERC
PATENT OFFICE
WASHINGTON, D. C.

Oct 5–1927. 192

EXAMINER OF INTERFERENCES:

An interference is found to exist between the followin cases, and in respect to the invention therein specifie to wit:

CASES

~~1. Name Otto J. Allen~~

~~Post office address 409 Sames-Moore Bld~~
~~Laredo, Webb County, Texa~~

~~Title Well Tester~~

~~Filed July 25, 1927 Ser. No. 208,150~~
~~Pat'd No.~~

~~Division or continuation of~~

~~Attorney Hardway & Cathey of 428 Banke~~
~~Mortgage Bldg., Houston, Tex~~

~~Associate Att'y of~~

~~Assignee of~~

~~(1)2. Name Conrad T. Neitzel~~
~~Post office address 2236 Live Oak St.,~~
~~Dallas, Texas.,~~

~~Title Well Testing Tools~~
~~Filed June 28, 1927 Ser. No. 202,150~~
~~(Reissue) of Patent No. 1625140, granted April 19/27, on appln. No. 167910, filed February 14, 1927.~~

~~Division or continuation of~~
~~Attorney Jack A. Schley, of 904 Allen Bldg., Dallas, Texas~~

~~Associate Att'y Alfred T. Gage, of 3915 Legation St., Washington, D. C.~~
~~Assignee of~~

~~(2)3. Name Charles L. Williams~~
~~Post office address 130 N. Negley Ave.;~~
~~Pittsburgh Pa.~~

~~Title Method of and Apparatus for Testing Wells~~
~~Filed June 4 1927 Ser. No. 196,461~~
~~Pat'd No.~~

~~Division or continuation of~~
~~Attorney Archworth Martin of 513 Union Trust Bldg., Pittsburgh, Pa.~~
~~Associate Att'y of~~
~~Assignee of~~

INVENTION

Consolidated with Intf. 55940

55941—1

[Stamped on face]: Intf. Number 55941 Intf. declared Oct 10 1927 Statements due Nov 14 1927

3 ~~4.~~ ~~Name: Ernest Powell~~
~~Post Office Address: Box 56A, Route 1,~~
~~Von Orma, Texas~~
~~Title: Well Tester,~~
~~Filed: May 10, 1927, Ser. No. 190,166,~~
~~Pat'd. No.~~
~~Attorney: Jesse R. Stone, of~~ C/o ~~Andrews~~
~~Streetman, Logue & Mobley~~
~~Union Nat. Bank Bldg., Houston, Texas~~
~~Associate Att'y~~
~~Assignee:~~

(1) ~~5.~~ Name: Guy V. Lewis
Post Office Address: Robert E Lee Hotel,
Lareda, Texas
Title: Well Testing Device
Filed: May 6, 1927, Ser. No. 189,294,
Pat'd. No.
Attorney: Jesse R. Stone; of
Andrews, Streetman, Logue & Mobley
Union National Bank Bldg., Houston, Texas
Associate Attorney:
Assignee:

~~(5)6.~~ ~~Name: David Erickson~~
~~Post Office Address: Erickson Pattern Works~~
~~508 Ohio Ave., Wichita Falls, Texas~~
~~Title: Oil Well Packers,~~
~~Filed: April 11, 1927; Ser. No. 182,817.~~
~~Pat'd. No.~~
~~Attorney: Watson, Coit, Morse & Grindle,~~
~~Mather Bldg., Washington, D. C.~~
~~Associate Att'y:~~
~~Assignee.~~ 55941--2

~~(6)7.~~ (6)~~7.~~ ~~Name: Edgar Clinton Johnston,~~

~~Post Office Address: El Dorado, Union Co., Arkansas,~~

~~Title: Well~~ Formation ~~Testing Device~~

~~Filed: Mar. 23, 1927, Ser. No. 177,719,~~
~~Pat'd. No.~~

~~Attorney: Clarence A. O'Brien,~~

~~Security Savings & Commercial Bank Bldg., Washington, D. C.~~

~~Associate Attorney:~~

~~Assignee:~~

~~Johnston Formation Testing Corporation of El Dorado, Arkansas~~

(2)~~8.~~ Name: Ernest H. Cox,

Post Office Address: Duncan, Stephens County, Oklahoma

Title: Oil Well Testing Device

Filed: Feb. 4, 1927, Ser. No. 165,984,
Pat'd. No.

Attorney: Eccleston & Eccleston of
Loan & Trust Bldg., Washington, D. C.

Assignee:

(3)~~9.~~ Name: John T. Simmons,

Post Office Address: P. O. Box 1411,
El Dorado, Arkansas

Title: Method and Apparatus for Testing Productivity of Formations Encountered Wells

Filed: Feb. 10, 1926, Ser. No. 87,323,
Pat'd. No.

Attorney: Lyon & Lyon,
708 National City Bank Bl
Los Angeles, C

Associate Att'y: J. M. Mason,
McGill Bldg., Washington, D

Assignee: Erle P. Halliburton, of
Los Angeles, C

Consolidated with Intf. 55940

INVENTION

11

Count 1: Apparatus for testing a well contai drilling fluid, which includes an empty string of pip be lowered in the well to adjacent the formation t tested, means at the lower end of the pipe to recei sample from the formation including an inlet ope into the pipe and a valve for controlling the inlet, means carried by the pipe for sealing the well above inlet, the valve being positively controlled by movemen the pipe.

5594

Sheet 4

12

Count 2: Apparatus for testing a formation encountered in a well containing drilling fluid, which includes a single string of pipe to be lowered into the well to adjacent the formation to be tested, a valved inlet at the lower end of the pipe positively controlled from the top of the well by movement of the pipe and a packer carried by the pipe above the inlet.

For counts 1 to 10 inclusive see Intf. 55940.

The relation of the counts of the interference to the claims is as follows:

Counts	Allen	Neitzel	Williams	Powell	Lewis	Erickson	Johnston	Cox	Simmons
11 1	18	23	15	13	15	21	11	12	28
12 2	19	24	16	14	16	22	12	13	29

(Counts Compared)

B.

Respectfully,

C. F. Krafft

Examiner, Division 38.

55941—4

[Stamped on face]: Docket Clerk Nov 1, 1928 Copy mailed

Hearing:

July 27, 1928. SET

In the United States Patent Office.

Allen v. Williams v. Powell v.
Lewis v. Erickson v. Johnston v. Cox v. Simmons.

Patent Interference No. 55,941.

Motion to Dissolve.

Well Tester.

Application of Otto J. Allen filed July 25, 1927, No. 208,150.

Application of Charles L. Williams filed June 4, 192[illegible] No. 196,461.

Application of Ernest Powell filed May 10, 1927, No. 190,166.

Application of Guy V. Lewis filed May 6, 1927, No. 189,294.

Application of David Erickson filed April 11, 1927, No. 182,817.

Application of Edgar C. Johnston filed Mar. 23, 192[illegible] No. 177,719.

Application of Ernest H. Cox filed Feb. 4, 1927, No. 165,984.

Application of John T. Simmons filed Feb. 10, 1926, No. 87,323.

Messrs. Hardway & Cathey for Allen.

Mr. Archworth Martin for Williams.

Mr. Jesse R. Stone for Powell and for Lewis.

Messrs. Watson, Coit, Morse & Grindle for Erickson.

Mr. Clarence A. O'Brien and Mr. Edwin E. Huffman for Johnston.

Messrs. Eccleston & Eccleston for Cox.

Messrs. Lyon & Lyon and Messrs. Mason & Mason for Simmons.

The party Lewis moves to dissolve on the ground that the counts are not patentable in view of the following patents:

Edwards,	No. 1,514,585,	Nov. 4, 1924,
Cooper,	No 1,000.583,	Aug. 15, 1911.

The party Johnston moves to dissolve on the ground that the counts are not patentable in view of the same Edwards patent.

The party Erickson moves to dissolve on the ground that the counts are not patentable in view of the same Edwards patent supplemented by the patent to Hemme, No. 976,737, Nov. 22, 1910, and also on grounds which are as follows:

(A) Now comes the party Erickson, by his attorneys, and moves that this interference be dissolved as to Count 1 as

55941 5

~~78~~

failing to properly define invention in accordance with Sec. 4888 of the Revised Statutes.

(B) It is further moved that the interference be dissolved as to Counts 1 and 2, as to the party Erickson, for the reason that the party Erickson cannot make the counts as drawn.

(C) In addition, if these counts are construed to read on Erickson, then in the same manner they will read on the patent to Cox, No. 1,347,534, July 27, 1920.

The Edwards patent does not anticipate the counts because the pipe 1 which carries the packer 5 is not the pipe with an inlet opening controlled by a valve, nor is the tapered end of stem 8, which may be the equivalent of a valve, positively controlled by movement of pipe 1. The sleeve 7 is not a means for sealing the well.

The party Lewis does not apply the Cooper patent in his motion and it requires no discussion. It is not apparent, however, from the consideration of this patent in connection with Interference No. 53,940 that it would anticipate the counts of the instant interference.

The motion of the party Johnston calls for no further discussion, since no additional reference other than the Edwards patent is cited. The Erickson motion does not assert that the Edwards patent fully anticipates the counts, but alleges that it is capable of obvious modification. The modification necessary to make the Edwards patent a sufficient reference is not taught by the patent to Hemme and would materially change the device of Edwards to introduce a new mode of operation.

No extensive discussion of the alleged functionality of count 1 is required. The count includes "means at the lower end of the pipe to receive a sample" and if anything more than an inlet opening and a valve is needed to enable the apparatus to receive a sample for testing, it would be

55941 6

necessarily implied. Obviously, it would be futile to receive a sample if it could not be carried to the top of the well for testing.

The party Erickson can make counts 1 and 2 so far as the limitation that the valve is positively controlled by movement of the pipe is concerned for reasons stated in the decision of the law examiner discussing his motion in Interference No. 55,940.

The Cox patent No. 1,347,534 is not anticipatory of the counts. The valve 15 does not close an inlet for pipe 1 which carries the sealing means or packer 10, and the glass plate 13a is not a valve. Valve 15 is not positively controlled by pipe 1.

The affidavits submitted on behalf of Simmons have been considered only so far as they appear to traverse a mode or capability of operation attributed to a reference (Rule 76).

The motions are denied.

I. P. Disney
Law Examiner.

November 1, 1928.

55941 7
~~80~~

3

[Stamped on back]: Assembled by M. H. Revised by .... Letter No. 136221 Date ....

No. D-56-Eq. Halliburton, et al vs. Honolulu Oil Corp. Plffs EXHIBIT No. 4-B Filed 11/11 1935 R. S. ZIMMERMAN, Clerk. By Cross Deputy Clerk.

[PLAINTIFFS' EXHIBIT No. 6.]

THE DISTRICT COURT OF THE UNITED STATES FOR THE EASTERN DISTRICT OF TEXAS, TYLER DIVISION.

LE P. HALLIBURTON
HALLIBURTON OIL
ELL CEMENTING COM-
NY, a corporation,

Plaintiffs,

vs. — In Equity No. 693.

HNSTON FORMATION
STING CORPORATION,
corporation, and E. C.
HNSTON,

Defendants.

INTERLOCUTORY DECREE

This cause having been tried and the Court having made entered its Findings of Fact and Conclusions of Law ein,

T IS HEREBY ORDERED, ADJUDGED AND CREE AS FOLLOWS:

. That Letters Patent of the United States No. 60,987, issued October 17, 1933, entitled "METHOD D APPARATUS FOR TESTING THE PRODUC-VITY OF FORMATIONS ENCOUNTERED IN ELLS", are good and valid in law, particularly as to ims 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18 and 19 reof.

2. That plaintiff, Erle P. Halliburton, is the sole and exclusive owner of the aforesaid Letters Patent, and that Halliburton Oil Well Cementing Company is the sole and exclusive licensee under said patent, and said plaintiffs are the owners of any and all rights of action and recovery for infringement thereof.

3. That the defendant, Johnston Formation Testing Corporation, has infringed United States Letters Patent No. 1,930,987, particularly claims 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19 thereof, by making, using and selling and causing to be made, used and sold apparatus like the apparatus illustrated in Exhibits A, B and C to defendants' answers to plaintiffs' interrogatories in this cause (Plaintiffs' Exhibit 14):

4. That a perpetual injunction issue out of and under the seal of this Court directed to the defendant, Johnston Formation Testing Corporation, its officers, agents, servants, employees and attorneys, or those in active concert or participating with them, enjoining and restraining them, and each and every of them, from directly or indirectly in any manner making, using or selling, or causing to be made, used or sold, any apparatus covered by claims 9 to 17 and 19 of Letters Patent No. 1,930,987 in suit, and from directly or indirectly using or causing to be used any method covered by claims 8 and 18 of said Letters Patent, which claims read as follows:-

8. A method of testing the productivity of a formation encountered in a well containing drilling fluid, which includes lowering an empty string of pipe into the well through the drilling fluid to adjacent the formation, the pipe carrying a packer and having a valved inlet at its lower end which is closed while the pipe is being lowered.

setting the packer above the formation to seal off the drilling fluid from the formation, opening the valved inlet after the packer is set to permit cognate fluid from the formation to enter the pipe, closing the valved inlet against the entrance of fluid from the well by movement of the pipe, raising the pipe so closed to remove an entrapped sample and the packer from the well.

9. Apparatus for testing a well comprising a string of pipe to be lowered into a well having an inlet at its lower end and carrying a packer adapted to be positively pressed against the walls of the formation to seal off the same above the inlet, and a valve for the inlet positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

10. Apparatus for testing a well comprising a string of pipe to be lowered into the well, a packer carried by the pipe said packer adapted to be positively pressed against the walls of the formation to seal off the same and means at the lower end of the pipe to receive a sample from the well including an inlet and a valve for controlling the inlet, the valve being positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

11. Apparatus for testing a well containing drilling fluid, which includes an empty string of pipe to be lowered in the well to adjacent the formation to be tested, means at the lower end of the pipe to receive a sample from the formation including an inlet opening into the pipe and a valve for controlling the inlet, and means carried by the pipe for sealing the well above the inlet said means consisting of a packer adapted to be positively pressed against

the walls of the formation to seal off the same, the val
being positively controlled by movement of the pipe.

12. Apparatus for testing a formation encountered a well containing drilling fluid, which includes a sing string of pipe to be lowered into the well to adjacent t formation to be tested, a valved inlet at the lower end the pipe positively controlled from the top of the well movement of the pipe and a packer carried by the pi above the inlet, said packer being adapted to be positive pressed against the walls of the formation to seal off t same.

13. Apparatus for testing the productivity of a fo mation encountered in a well containing drilling flu which includes an empty string of pipe to be lowered in the well to adjacent the formation to be tested, a pack carried by the pipe adapted to be positively pressed agai the walls of the formation to seal off the same, means the lower end of the pipe to receive a sample from t formation including an inlet opening into the pipe and valve structure for controlling the inlet, the valve stru ture including a plurality of relatively movable parts o of which is secured to the pipe and another of which connected to the packer.

14. Apparatus for testing the productivity of a fo mation encountered in a well containing drilling flu which includes a single empty string of pipe to be lowe into the well to adjacent the formation to be tested, mea lowered into the well by said string of pipe for seali off the drilling fluid from the formation to be tested, s sealing means being adapted to be positively pres against the walls of the formation to seal off the sa means at the lower end of said string of pipe to receiv

sample from the formation including an inlet opening into said pipe and a valve structure for controlling the inlet, said valve structure including a part connected to said sealing means and a part connected to said pipe.

15. Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, comprising a single empty string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to be tested, a packer lowered into the well by said string of pipe for sealing off the drilling fluid from the formation to be tested, said packer adapted to be positively pressed against the walls of the formation to seal off the same, means at the lower end of said string of pipe to receive fluid from said formation including an inlet opening into said pipe below said packer and a valve structure for controlling the inlet, said valve structure having a relatively stationary part connected to the packer and a relatively movable part connected to the pipe.

16. Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, comprising a single empty string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to be tested, a packer carried by the pipe for sealing off the well above the formation an inlet below the packer opening into the pipe, said packer adapted to be positively pressed against the walls of the formation to seal off the same, and a valve for the inlet, the setting of the packer and the operation of the valve being positively controlled by movement of the pipe.

17. Apparatus for testing a well containing drilling fluid, comprising a single string of pipe to be lowered into the well through the drilling fluid, said pipe being closed

against the entrance of the drilling fluid, means at lower end of the pipe for receiving a sample includin inlet opening into the pipe, means carried by the pipe sealing the well above the inlet, said sealing means ada to be positively pressed against the walls of the form to seal off the same, and a valve for the inlet that ma positively opened and closed by movement of the while the well is sealed above the inlet.

18. A method of testing the productivity of a fo tion encountered in a well containing drilling fluid in ing the insertion of only a single string of pipe into well to make a test, which includes lowering a test s into the well through the drilling fluid with a packer ried by the string and a valve inlet at the lower en the string closed against the entrance of fluid from well, setting the packer above the formation and ope the valve to permit cognant fluid from the formati enter the inlet, closing the valve to prevent the subsec entrance of fluid from the well through the inlet releasing the packer, and raising the test string with inlet closed against entrance of fluid from the w remove an entrapped sample.

19. An apparatus for testing the productivity formation in a well containing drilling fluid, compr a string of pipe to be lowered into the well through drilling fluid to adjacent the formation to receive a sample therefrom and to be raised out of the well t move the entrapped sample, said pipe being closed ag the flow of the drilling fluid as the pipe is lowered the well, a packer carried by the pipe as the pipe is low into the well and adapted to be seated by manipulatio the pipe to seal off the well above the formation,

packer adapted to be positively pressed against the walls of the formation to seal off the same, an inlet to the pipe communicating with the well below the point at which the packer seals off the well, and means for controlling the inlet to permit fluid from the formation to enter the pipe while the packer is set and to prevent fluid from entering the pipe after the packer is released and the pipe is being raised out of the well."

5. That the plaintiffs, Erle P. Halliburton and Halliburton Oil Well Cementing Company, recover from the defendant Johnston Formation Testing Corporation the profits and damages arising out of or accruing from the infringement by the defendant Johnston Formation Testing Corporation of the Letters Patent in suit, and that this cause be referred to..., Esq., as Special Master *pro hac vice* to ascertain such profits and damages and report the same to the Court, upon which accounting the Special Master shall ascertain and report as to whether or not in fact and law the defendant E. C. Johnston should be held personally liable for the payment of such profits and damages in the event of a failure of the defendant Johnston Formation Testing Corporation to pay the same.

6. That the plaintiffs Erle P. Halliburton and Halliburton Oil Well Cementing Company recover from the defendant Johnston Formation Testing Corporation the costs and disbursements in this suit in the sum of............. Dollars, to be taxed and that plaintiffs have execution therefor.

Dated this 5th day of September 1935.

Randolph Bryant
United States District Judge.

APPROVED AS TO FORM:

Ben F. Saye
Leonard S. Lyon
Henry S. Richmond
Attorneys for Plaintiffs.

8-23-35 Copy received but not approved.

D. A. Simmons, for Defendants

....

....

....

Attorneys for Defendants.

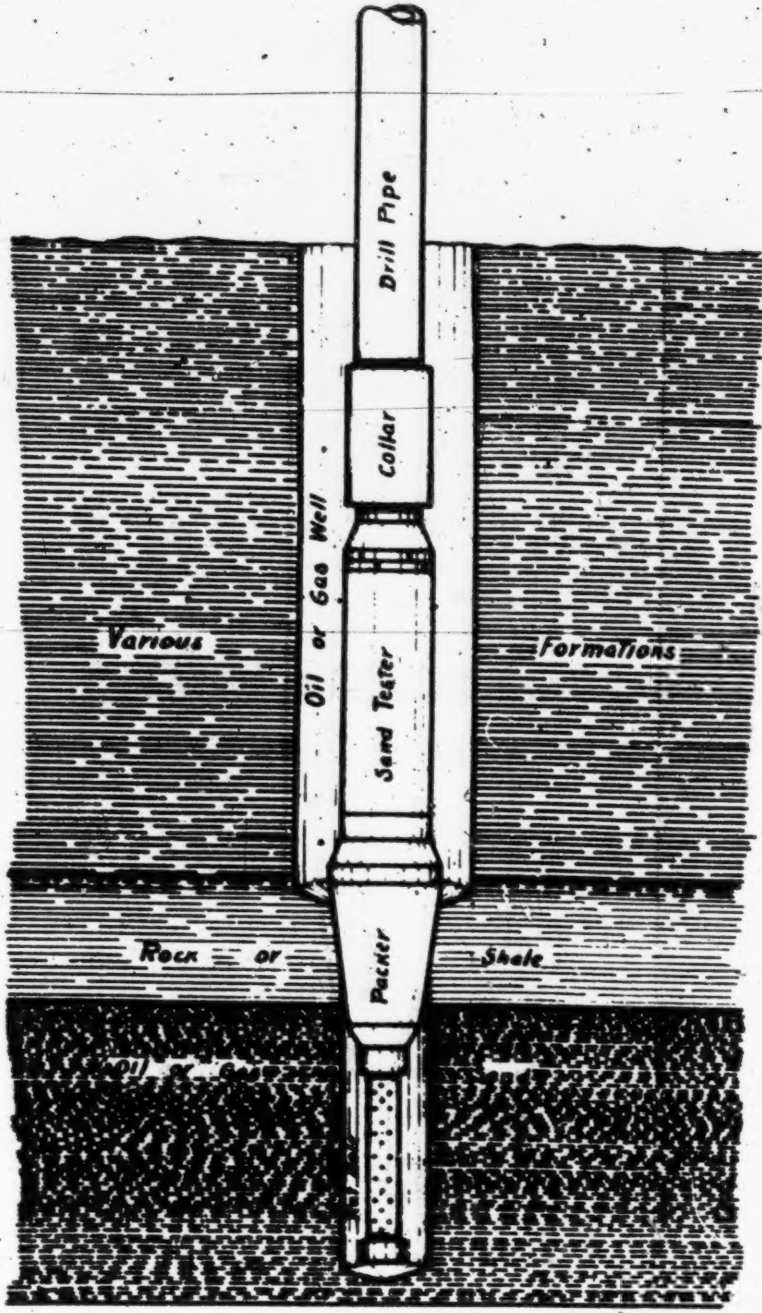
UNITED STATES OF AMERICA)
) ss:
Eastern District of Texas)

I, Helen Mathews, Clerk of the United States District Court in and for the Eastern District of Texas, do hereby certify that the annexed and foregoing is a true and full copy of the original Interlocutory Decree, in the case of Erle P. Halliburton and Halliburton Oil Well Cementing Company vs. Johnston Formation Testing Corporation, a corporation and E. C. Johnston, No. 693 In Equity, Tyler Division. now remaining among the records of the said Court in my office.

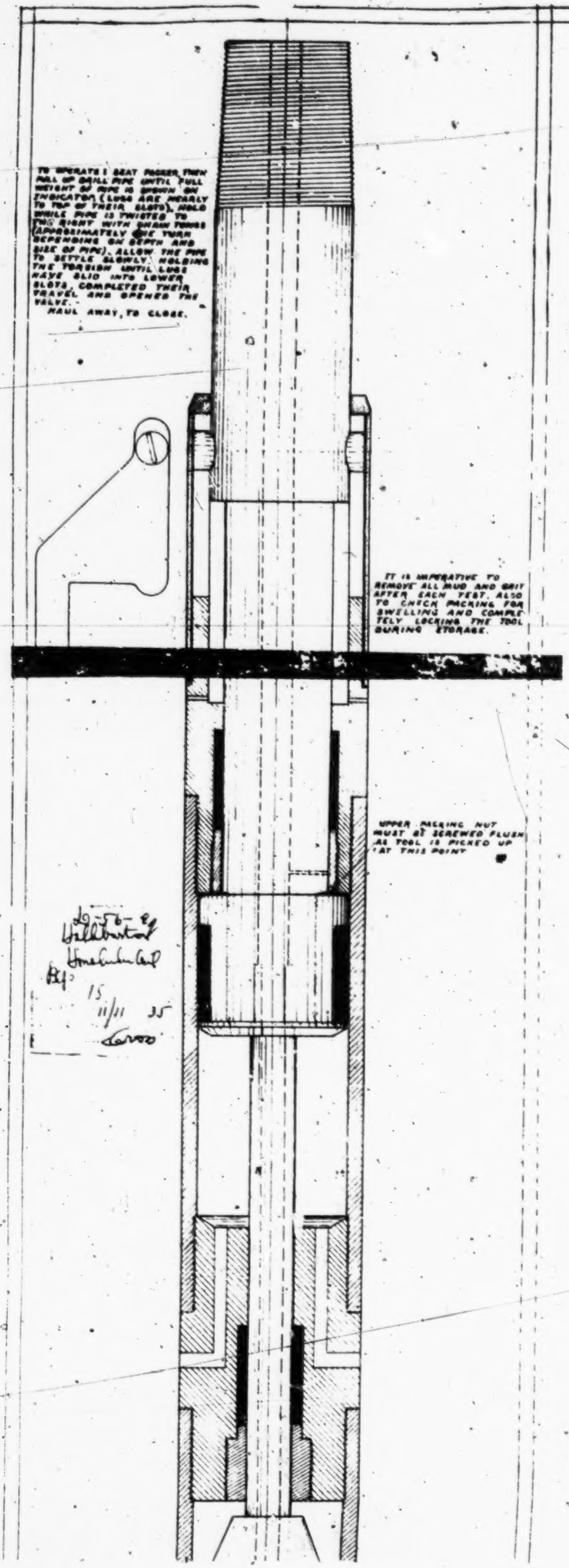
IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the seal of the aforesaid Court at Sherman, Texas this 5th day of September, A. D. 1935

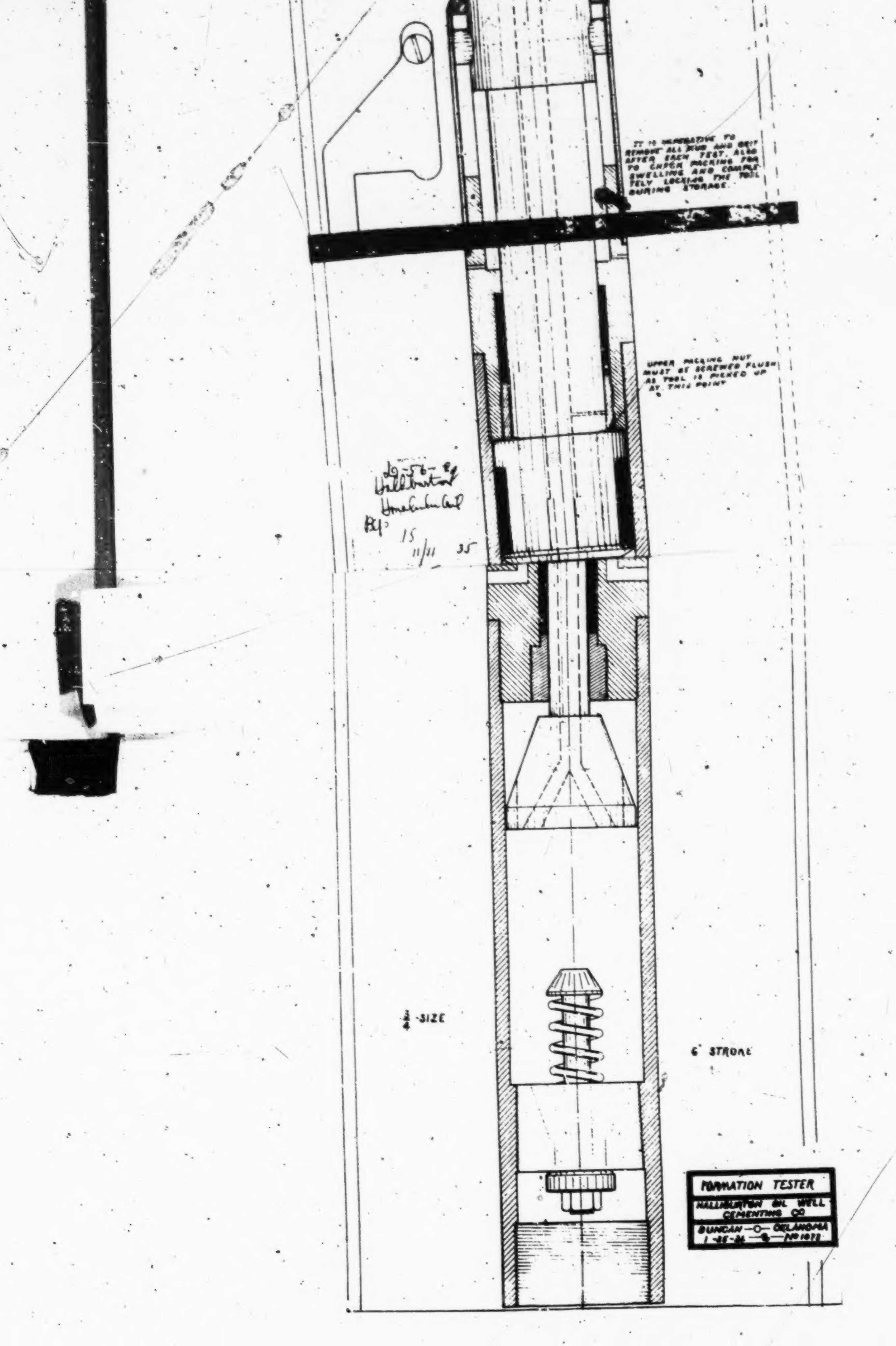
[Seal] Helen Mathews Clerk.
By F. Z. Edwardson Deputy Clerk.

No. D-56 Eq. Halliburton et al vs. Honolulu Oil Corp. Plfs Exhibit No. 6 Filed 11/11 1935. R. S. Zimmerman, Clerk By Cross, Deputy Clerk in evid 11/21/35


Drill Pipe
Collar
Oil or Gas Well
Sand Tester
Various
Formations
Rock or Shale
Packer
Oil or Gas

10A


TO OPERATE: SEAT PACKER, THEN PULL UP DRILL PIPE UNTIL FULL WEIGHT OF PIPE IS SHOWN ON INDICATOR (LUGS ARE NEARLY TO TOP OF THEIR SLOTS), HOLD WHILE PIPE IS TWISTED TO THE RIGHT WITH SWAN TONGS (APPROXIMATELY ONE TURN DEPENDING ON DEPTH AND SIZE OF PIPE). ALLOW THE PIPE TO SETTLE SLOWLY, HOLDING THE TORSION UNTIL LUGS HAVE SLID INTO LOWER SLOTS, COMPLETED THEIR TRAVEL AND OPENED THE VALVE.-
HAUL AWAY, TO CLOSE.
IT IS IMPERATIVE TO REMOVE ALL MUD AND GRIT AFTER EACH TEST. ALSO TO CHECK PACKING FOR SWELLING AND COMPLETELY LOCKING THE TOOL DURING STORAGE.
UPPER PACKING NUT MUST BE SCREWED FLUSH AS TOOL IS PICKED UP AT THIS POINT
15
11/11 35



IT IS IMPERATIVE TO REMOVE ALL MUD AND GRIT AFTER EACH TEST. ALSO TO CHECK PACKING FOR SWELLING AND COMPLETELY LOCKING THE TOOL DURING STORAGE.
UPPER PACKING NUT MUST BE SCREWED FLUSH AS TOOL IS PICKED UP AT THIS POINT
15
11/11
35
3/4 SIZE
6" STROKE
FORMATION TESTER
HALLIBURTON OIL WELL CEMENTING CO
DUNCAN — OKLAHOMA

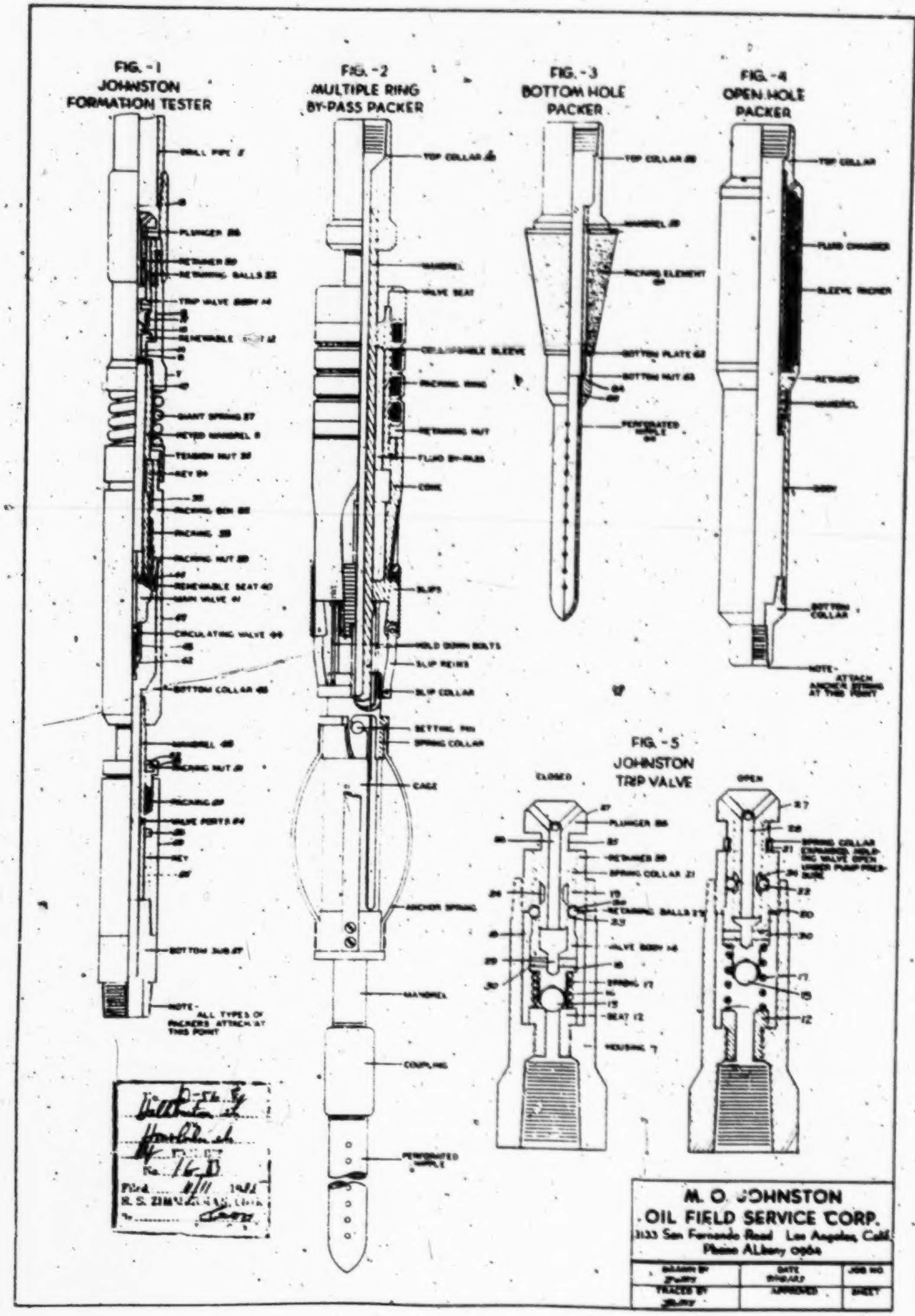


FIG. -1
JOHNSTON
FORMATION TESTER
FIG. -2
MULTIPLE RING
BY-PASS PACKER
FIG. -3
BOTTOM HOLE
PACKER
FIG. -4
OPEN HOLE
PACKER
FIG. -5
JOHNSTON
TRIP VALVE
CLOSED
OPEN
TOP COLLAR
MANDREL
VALVE SEAT
COLLAPSIBLE SLEEVE
PACKING RING
RETAINING NUT
FLUID BY-PASS
CONE
SLIPS
HOLD DOWN BOLTS
SLIP REINS
SLIP COLLAR
SETTING PIN
SPRING COLLAR
CAGE
ANCHOR SPRING
COUPLING
PERFORATED NIPPLE
FLUID CHAMBER
SLEEVE PACKER
RETAINER
BODY
BOTTOM COLLAR
PACKING ELEMENT
BOTTOM PLATE
BOTTOM NUT
PLUNGER
RETAINER
TRIP VALVE BODY
RENEWABLE SEAT
GIANT SPRING
TENSION NUT
KEY
PACKING BOX
PACKING
PACKING NUT
MAIN VALVE
CIRCULATING VALVE
VALVE PORTS
BOTTOM SUB
NOTE - ALL TYPES OF PACKERS ATTACH AT THIS POINT
NOTE - ATTACH ANCHOR SPRING AT THIS POINT
RETAINING BALLS
VALVE BODY
SPRING
SEAT
HOUSING
M. O. JOHNSTON
OIL FIELD SERVICE CORP.
3133 San Fernando Road Los Angeles, Calif.
Phone ALbany 0964
DRAWN BY
DATE
JOB NO
TRACED BY
APPROVED
SHEET
Filed
R. S. ZIMMERMAN, Clerk

Exhibit B

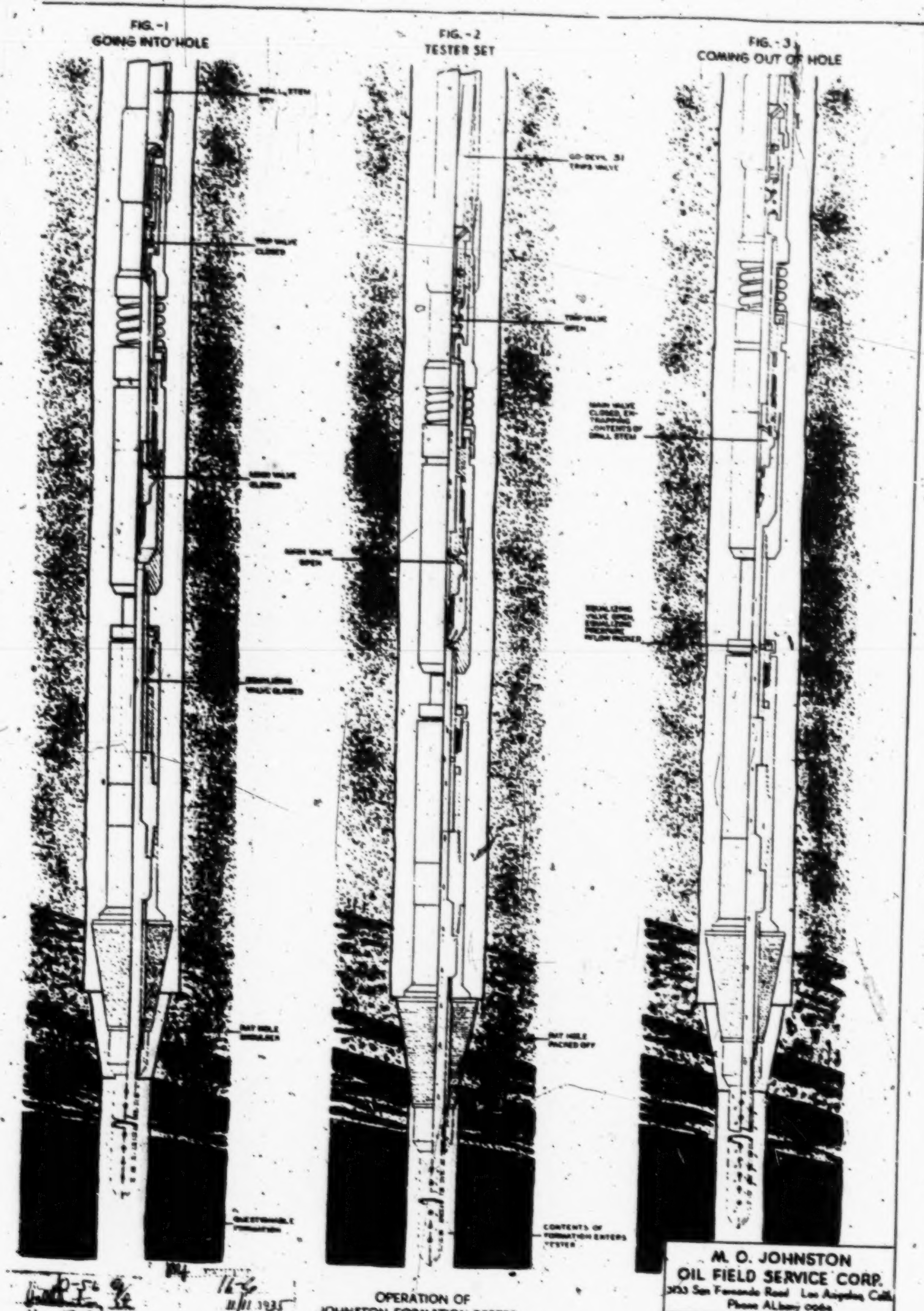


EXHIBIT C

286

OPERATION OF
JOHNSTON CASING TESTER

16-10
11/11 31

IC-56
Halliburton Co
Honolulu Co

EXHIBIT D

227

[PLAINTIFFS' EXHIBIT No. 17.]

ssrs. Lyon & Lyon, Sherman, Texas.
orneys at Law, July 6, 1935.
ional City Bank Building,
Angeles, California.
orable Ben F. Saye,
rney at Law,
can, Oklahoma.
srs. Simmons & Arnold,
rneys at Law,
ston, Texas.
srs. Saye & Saye,
rneys at Law,
gview, Texas.
orable Benjamin F. Bledsoe,
Hill, Morgan & Bledsoe,
rneys at Law,
Roosevelt Building
Angeles, California.

: Erle P. Halliburton and Halliburton Oil Well Cementing Company v. Johnston Formation Testing Corporation, et al. Equity No. 693, Tyler Division.

lemen:

ter full consideration of the above entitled matter, e concluded that John T. Simmons is the sole, only original inventor of the testing device or apparatus ed by the patent in suit. That the patent belongs to Halliburton as the assignee of the inventor, and that xclusive license to operate under the same has been rred upon the Halliburton Oil Well Cementing pany.

#2.

That the patent is valid as to both the apparatus method claims. That the defendants have infringed u plaintiff's rights and that plaintiffs are entitled to re in the usual form.

In view of the full review of this matter by the Pat Office, which has been made a matter of record here I have decided that it would be superfluous effort for to attempt to write an opinion in this matter.

Accordingly, attorneys for the complainant may pr pare and submit to opposing counsel proposed forms findings of fact and conclusions of law, and final form decree in accordance with the above indications.

If counsel cannot approve of these matters as to for I shall be glad to settle the form of the same upon noti of that fact.

I wish to say to you gentlemen frankly, that this ca has caused me more trouble and concern than any oth that I have ever tried, but if there is error in the resu reached, I trust that you gentlemen will see that it corrected.

Very truly yours,

Randolph Bryant

No. D-56-Eq Halliburton vs. Honolulu Plf Exhib No. Plf. 17 Filed 11/21 1935 R. S. Zimmerman, Cler By Cross, Deputy Clerk

Jno. Z. Simms Co. Jan, 22, 1926

IN ACCOUNT WITH

EBY ENGINEERING COMPANY

SAMUEL H. EBY, C. E.

EL DORADO, ARK.

20	1	Special Drawing 3 Blue Prints	11.00

Paid
EBY ENGINEERING COMPANY
Per. E. L. Phillips

D-56 Eq Halliburton v. Amolite etc
11/21/35
R. S. Zimmerman, Clerk
By [illegible] Deputy

Halliburton v. Johnston
Equity #693
Plaintiff's Exhibit "8"

PRIOR FRANKLIN PATENT 263,330

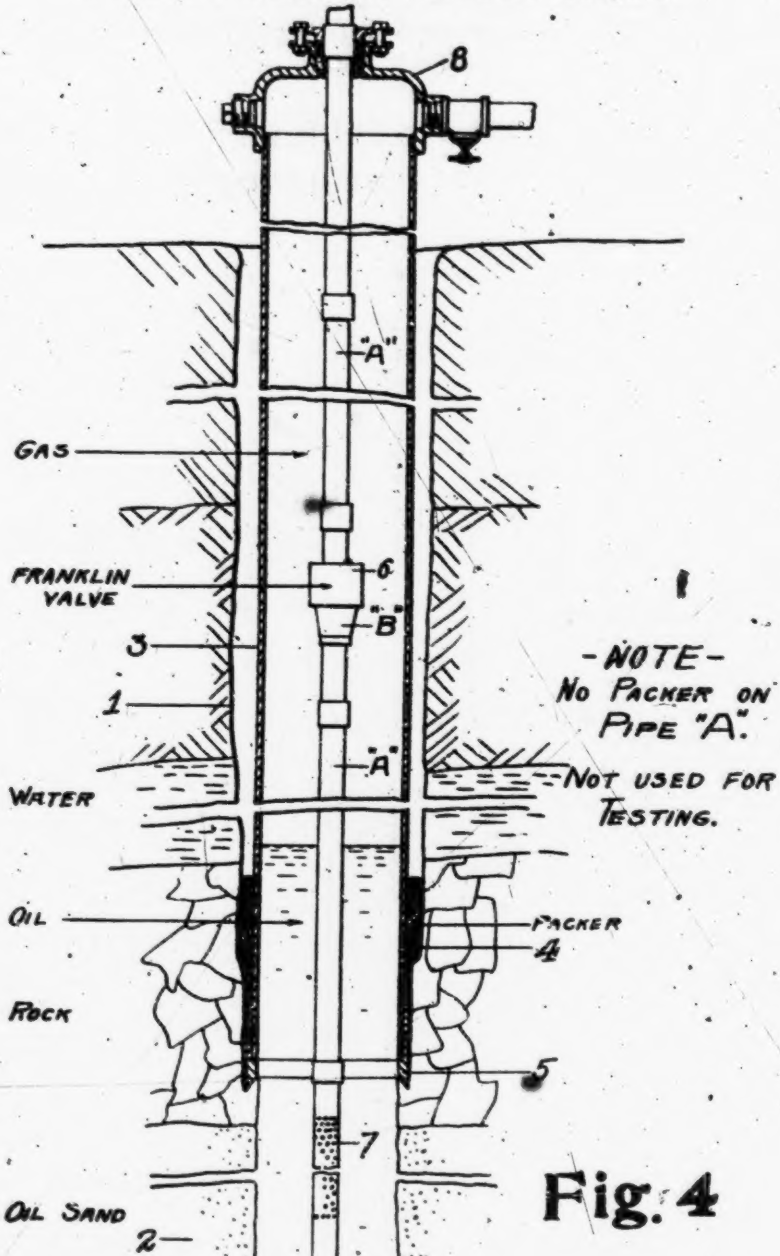


Fig. 4

H-E TOOLS

Reversing Tools and Casing Cutters

Insure Satisfactory Service

These tools were developed after years of actual contact with all kinds of difficult fishing jobs by experienced engineers.

Can be released at will. Will operate with strain on pipe. Has wide range of adjustment. Makes left-handed pipe unnecessary. Successful operations prove statements.

When you find it necessary to use left-handed pipe, save the expense and use the EDWARDS REVERSING TOOL.

Save the Casing Seat! Dont Risk Side Track!

Use an Edwards Cut and Pull Inside Casing Cutter and avoid water troubles. Cuts and pulls at one trip.

No mandrel—Use drill stem only.

REVERSING TOOLS, INSIDE CUTTERS, OUTSIDE CUTTERS, SPEARS, JARS, OVERSHOTS, TAPER AND BOX TAPS, FLOW TESTERS AND OTHER SPECIALTIES.

At Your Supply Store

HOUSTON ENGINEERS, Inc.

Phone Preston 1927 — Night, Taylor 1996
Postoffice Box 276
HOUSTON, TEXAS

H-E TOOLS

CHAS. R. EDWARDS, PRESIDENT   CHAS. W. MARKLE, VICE-PRESIDENT   TRACY T. WORD, SECRETARY-TREASURER

HOUSTON ENGINEERS, INC.

POST OFFICE BOX 276

xclusive licensees and owners of the Reversing Tools nd Releasing Fishing Tools, formerly manufactured by he Mark Manufacturing Company of Houston, Texas.

PHONE PRESTON 182
NIGHT TAYLOR 1989

HOUSTON, TEXAS

Halliburton v. Johnston
Equity #693
Plaintiff's Exhibit "30"

Device Tests Stratum With Drill Stem in Hole

A device used on the drill stem, ot test the oil flow possibilities of any promising stratum while drilling, has been designed by Chas. R. Edwrads, president of the Houston Engineers, Inc., Houston, Texas.

In fact it is claimed that with this device the mud pumps can maintain the mud circulation through the rotating drill stem while the oil is actually flowing to the surface of the ground through the test tube from an oil bearing stratum at the bottom of the well.

Oil Tester for Wildcat Wells

The cut herewith shows the tester in vertical cross-section. The upper section is the blowout preventer swivel used above the rotary table. The pump connection is through a tee side opening just below the blowout preventer, and above the elevator connection which is immediately above the upper swivel gland.

The tester proper is shown in the lower part of the cut, and at the very bottom of the cut is shown a packer. This may be any suitable open hole packer such as is now on the market. Above the packer connection is the lower swivel. At the top of the lower part of the cut is the drill stem lower connection.

Two sections of the test tube are shown. For four-inch drill stem with standard tool joints, the test tube is usually of one and one-fourth inch tubing. At the lower end of the test tube is a section of perforated tubing with very small perforations. At the upper end of the perforated section of the inside of the test tube is a knock-out plug.

The bottom of the lowest test tube is beveled to make a tight joint in the lead seal shown at upper end of the perforated joint of the test tube.

Arrows inside the test tube show the mud circulation courses.

The packer is set and the test tube seated in the lead seal. This separates the well into two compartments.

The lower compartment can be opened into the test tube by dropping a light go-devil into the empty test tube breaking the knock-out plug at the top of the perforated bottom joint of the test tube. This is equivalent to instantly bailing the well dry so far as the lower compartment is concerned.

The oil and gas, if any, now being suddenly relieved of the enormous mud pressure can flow up to the surface through the test tube, giving the operator, it is claimed, positive knowledge of not only its presence, but its quality and quantity as well as the gas pressure, thus directing him how to prepare to handle the well in the proper way.

It is claimed that this device will shorten the time and very greatly lessen the expense of wildcatting and thoroughly test a lease as every foot of the hole can now be flow tested without setting screen and casing.

The test is made by actually flowing the oil from the well if present in the stratum tested.

It is also claimed that the time required to flow a test well in this manner is very little more than that required to run a core barrel, and the expense of this method is less than that of coring since from 50 to 100 feet of structure may be flow tested.

Additional information can be had from the Houston Engineers, Incorporated, P. O. Box 277, Houston, Texas.

Casing Cutter Combined With Reliable Grapple

A Casing Cutter combined with reliable grapple that pulls the cut off section of casing at the same trip the cut is made has been designed by Chas. R. Edwards, president of the Houston Engineers, Inc., of Houston, Texas.

The cutters, of the well known wheel type, are driven out and withdrawn, by a reliable rack and gear movement. This type of drive also makes it possible to cut the smaller sizes of casing.

An interlock located between the casing grapple and the cutters controls the cutters that they remain inoperative while rotating and washing down. The interlock is released only when an upward strain is taken on the casing.

This, it is claimed, is a very important feature; the upward strain carrying the weight of the casing about to be cut relieves the cutters of the entire weight of the casing above. Thus cutter breakage is reduced to a minimum and the main objection to the use of casing cutters is overcome.

Houston Casing Cutter and Grapple

Provision is made to give the operator notice as soon as the casing is cut in two.

Ample provision is made to release the casing hold if more casing is cut off than can be pulled.

A new cut can be made by simply moving up or down to a new location and taking a new hold. This is accomplished without coming out of the well, there being no triggers or trips about this casing cutter that require hand resetting after a casing hold has been made.

A great deal of time and expense is also saved by being able to rotate down, wash down, cut and pull the cut off casing at one trip.

Further information will be supplied by the Houston Engineers, Inc., P. O. Box 276, Houston, Texas.

[DEFENDANT'S EXHIBIT A.]

390

DEPARTMENT OF COMMERCE

United States Patent Office

To all persons to whom these presents shall come, Greeting:

THIS IS TO CERTIFY that the annexed is a true copy from the records of this office of the File Wrapper, Contents and Drawings, in the matter of the abandoned

Application of
Erle P. Halliburton,

Filed December 28, 1926, Serial Number 157,573,

for

Improvement in Well Testing Device.

In Testimony Whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this fourth day of October, in the year of our Lord one thousand nine hundred and thirty-five and of the Independence of the United States of America the one hundred and sixtieth.

(Seal
Attached)

Attest:
D. E. Wilson
Chief of Division.

Conway P. Coe
Commissioner of Patents.

Number (Series of 1925) PATENT NO

157573 ~~1927~~ Dated

Div. 38 1926 Ex'r's Book) J 20

76

Division of App. No............., filed ...., 19.......

Name ERLE P. HALLIBURTON

of LOS ANGELES

State of CALIFORNIA

Invention WELL TESTING DEVICE

ORIGINAL

Application Filed Complete Dec 28, 1926

Parts of Application Filed

Petition, Specification,
Oath, First Fee $20,
2 sheets Drawings, } Dec 28, 1926

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Examined and passed for Issue ...., 192

.... Exr. Div. ....

Notice of Allowance ...., 192

By Commissioner

Final Fee.., 192

RENEWED

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Reexam'd and passed for Issue........................, 192

.... Exr. Div. ....

Notice of Allowance ...., 192

By Commissioner.

Final Fee ...., 192

Attorney LYON & LYON 708 NATIONAL CITY BANK BLDG LOS ANGELES CALIF

Associate Attorney..

No. of Claims Allowed .... Print Claims..................

in O. G. Class..

Title as Allowed..

[Stamped]: $20- Rec'd Dec 28 1926 C.C.U.S. Pat. Offic
CK C

Frederick S. Lyon
Leonard S. Lyon

Henry S. Richmond
George H. Hiles
Richard F. Lyon
Francis D. Ammen
Lewis E. Lyon

Telephone
FAber 316

Law Offices
LYON & LYON
PATENT AND TRADEMARK CAUSES
National City Bank Building
Los Angeles

December 23, 1926.

Commissioner of Patents,
Washington, D. C.

Dear Sir:

Enclosed herewith find the application of Erle P. Hal burton for United States Letters Patent on WEL TESTING DEVICE; also our check No. 1790 for $20. in payment of the filing fee thereon.

Kindly file, acknowledge receipt, and oblige,

Yours very truly,

B-Encl.

157573 1 R

[Stamped] Mail Room Dec 28 1926 U.S. Patent Office
2 157573

Petition and Power of Attorney

To the Hon. Commissioner of Patents:

Your petitioner, ERLE P. HALLIBURTON, a citizen....of the United States, residing at Los Angeles, in the County of Los Angeles, and the State of California, whose post-office address is Duncan, Oklahoma, prays that letters patent may be granted to him for the WELL TESTING DEVICE, set forth in the annexed specification, and....he....hereby appoints the firm of

Lyon & Lyon

(the individual members of which firm are Frederick S. Lyon and Leonard S. Lyon), 708 National City Bank Building, Los Angeles, California his attorneys, with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to receive the patent and to transact all business in the Patent Office connected therewith.

Inventor sign full name: { Erle P. Halliburton

Specifications

To All Whom it May Concern
Be it know that

I, ERLE P. HALLIBURTON, a citizen of th United States, residing at Los Angeles, in the Count of Los Angeles, State of California, have invente a new and useful

WELL TESTING DEVICE,

of which the following is a specification:

This invention relates to an apparatus for testin the productivity of formations encountered in drillin oil and other deep wells, and refers particularly to a apparatus to be employed when such wells are drille by the rotary method.

In the rotary method of drilling wells, the well i kept filled with a mud-laden fluid. In most wel drilled by the rotary process, it is impossible withou danger to the hole to remove the mud-laden fluid with out providing some other support to prevent the wal of the well from collapsing. The hydraulic pressur of the mud-laden fluid in the well is very great, bein often in excess of 2000 pounds per square inch. I most instances, this pressure is in excess of the hea upon the cognate fluids, either oil, water, or gas, en countered in the formations penetrated by the dril Under these circumstances while drilling, there ma be no indication whatever at the surface of the wel of the productivity or even existence of such cognat fluids. It is therefore necessary to perform a specia testing operation whenever it is desired to

determine whether a formation in a well contains a fluid which, upon removal of the pressure of the mud-laden fluid, will enter the well bore.

It is the general practice when making such a test to set a string of casing or plurality in strings in the well so that such string of casing may support the walls of the well when the mud-laden fluid is withdrawn. If a water sand has been encountered above the formation to be tested, it is necessary to run in a separate string of casing and cement or otherwise seal its bottom to the sides of the well bore at a point below the known water level in order to protect the formation being tested from this upper water strata. In testing the well, the hole below the bottom of this water string is then protected by another string set inside of the water string. The mud-laden fluid is then removed from the well.

In case the test develops that the formation tested is barren or not commercially productive or contains water, and it is therefore desired to deepen the hole, it is necessary to refill the hole with mud-laden fluid, to remove if possible the inner string, and to resume drilling. The cemented string of casing must be left in the hole, which not only entails the cost of this string of casing, but decreases the size of the hole which can thereafter be drilled.

An object of the present invention is to provide an apparatus for testing formations encountered in well drilling which apparatus may be employed without the necessity of removing the mud-laden fluid from the well bore and which apparatus may be employed without the necessity of cementing off any

of the water strata above the formation to be tested. The device of the present invention is designed to provide an empty conduit leading from the formation to be tested to the top of the well, which conduit is closed from communication with the mud-laden fluid of the well and is adapted to be opened and closed from the top of the well to establish as desired communication with the formation to be tested. The apparatus of the present invention provides means by which the mud laden fluid in the well may be packed off from the formation to be tested.

Another object of the present invention is to provide a device for testing a well which may be readily operated from the surface of the well without substantial danger of the device being frozen within the well hole, and also provide a device which is self-cleaning and hence will not become clogged.

Another object of the present invention is to provide a device through which continuous production from the well may take place when the pressure on the fluids within the well is sufficient to elevate the fluid to the surface of the well, and at the same time provide a means by which, when the pressure on the fluids of the well is insufficient for this purpose, such fluids may be positively trapped within the testing device and removed to the surface of the well where an indication of the quantity and quality of such fluids may be had.

The present invention together with various further objects and advantages thereof will best be understood from a description of a preferred form or example of an apparatus or device embodying the invention. For this purpose, there is hereafter described the preferred type of well testing device

embodying the present invention. Such device is illustrated in the accompanying drawings, in which:

Figure 1 is an elevation showing the device in position in a well hole, the well hole and parts of the apparatus being in vertical section,

Figure 2 is an enlarged vertical elevation mainly in section of the lower end of the testing device,

Figure 3 is a similar view at right angles to Figure 2, the lower end being broken away,

Figure 4 is a section on the line 4-4 of Figure 2,

Figure 5 is a section on the line 5-5 of Figure 2,

Figure 6 is a section on the line 6-6 of Figure 2, and,

Figure 7 is a section on the line 7-7 of Figure 2.

Referring to the drawings, the apparatus is illustrated as consisting mainly of the following elements: A casing 2 which may be formed in a plurality of sections held together by couplings 3, or other means adapted to provide an empty chamber or a conduit which may be lowered into a well bore such as 4, and when so lowered provide an empty chamber adjacent the formation 5 to be tested. The apparatus also comprises a valve 6 normally closing the lower end of said casing or conduit 2, and below said valve is provided an inlet line 7. There is also provided packing means 8 above the inlet line 7 by which the mud-laden fluid within the well may be shut off from the inlet end of the device.

The inlet member 7 is formed by a casing, the upper portion 9 of which mounts the packing 8. The packing 8 is indicated as tapering downwardly and may be formed of any suitable packing material. The lower end of the packing engages a follower 10 which is held upon the casing 9 by a collar 11. The lower end of the inlet member 7 is formed by a perforated casing 12 which operates as a screen for the fluid entering the testing device. The perforated section 12 is held to the upper section 9 by the collar 11 and the lower end of the perforated section 12 is closed by the cap 13.

The collar 11 also serves to mount a bearing 14 and the cap 13 serves to mount a bearing 15. Said bearings support an eccentric shaft 16 which forms part of a means for automatically cleaning the perforations of the screen section 12. The upper end of said shaft 16 mounts an impeller 17 adapted to be auto-

matically rotated by fluid passing upwardly through the device and the eccentric portion of the shaft 16 supports a plurality of rotary perforation cleaning elements 18 which are indicated as formed in the shape of star wheels, the individual arms 19 of which are spaced apart corresponding to the spacing of the perforations in the screen pipe 12 so that said devices 18 may rotate around the perforations successively, punching and cleaning the same out. It is understood that this automatic cleaning device is adapted not only for use in connection with the present testing device but is adapted for use wherever it is desired to employ a self-cleaning screen pipe or casing in a well.

The upper section 9 of the inlet member is threaded to a box on a body member 20 which also engages the upper end of the packing 8. Said body member 20 has a vertical bore 21 therethrough, and the valve 6 is positioned in this bore 21. Said valve 6 comprises a tapered plug 22 adapted in one position to close the passage 21, and having a transverse passage 23 which is adapted to be rotated into register with the passage 21 for opening the same. The plug 22 of the valve 6 is integral or rigid with a gear 24 by which the valve may be opened and closed.

The valve body 20 and supported inlet member 7 are swivelly connected to the casing or conduit 2 and for this purpose, the conduit 2 is threaded to a head 25 by its pin 26. A bearing, such as the ball race 27, is provided between the body 20 of the valve and the head 25 and the lower end of the head 25 is provided with a bevel gear 28 which meshes with the gear 24 of the valve 6 whereby relative rotation between the head 25 and the body 20 will rotate the valve 6.

To support the valve body and inlet tube upon the head 25, the head 25 is provided with a shoulder 30 and a sleeve 31 is threaded to the body 20 and extends up enclosing the valve, and bearings 27, to above the shoulder 30 where said sleeve is threaded to a member 33 engaging said shoulder. Said member 33 also serves as a packing box receiving packing 34 held down by a packing gland 35, which prevents the entrace of mud-laden fluid. Above the gland 35, a split tapered collar 36 is bolted in place which eliminates any sharp shoulder on the top of the device which might otherwise catch upon any obstructions in the well hole.

The head 25 is provided with a vertical bore 37 aligning with the bore 21 of the valve body 20, which bore 37 receives a tube 38 which is threaded to the valve body 20 and extends up to near the top of the head 25. Said tube is there engaged by packing 39 compressed by a gland 40 in the head 25. The gland 40 is also attached to a tubing 41 of considerably less outer diameter than the inner diameter of the casing 2, and said tubing 41 extends upwardly for a considerable distance.

The sleeve 31 also supports a stop member 42 in the form of a pin threaded therein, which engages an arcuate slot 43 in the head 25 and provides a means for limiting the relative rotation between the head 25 and valve body 20 so that at the limits of said relative rotation, the body 20 will be in the maximum open and maximum closed positions.

The device is preferably operated or employed in the following manner: Whenever it is desired to test a formation in a well, there is first drilled in the formation 5 to be tested a hole 50 of less size than the adjacent well bore, which reduced

size hole is ordinarily referred to in the art as a "rat hole". The inlet member 7, valve body 20, and head 25 and connected parts are then attached to the lower end of the casing, such as 2, with the valve 6 in the closed position. At this time, the device above the valve 6 is empty of any fluid except, as indicated at 51, a quantity of fluid may be placed between the tubing 41 and the casing 2. This fluid is for the purpose of assisting in the support of the lower end of the casing 2 from collapsing under the heavy hydraulic pressure of the mud-laden fluid indicated at 52 in the well. It is understood, however, that generally in the use of the invention, the tubing 41 and liquid 51 is not necessary and is only employed when the device is to be utilized to test an extremely deep well where the hydraulic pressure of the mud-laden fluid 52 therein may be in excess of the strength of the casing 2. Where the hydraulic pressure of the mud-laden fluid in the well is in excess of the strength of the casing 2, the tubing 41 is positioned in place extending sufficiently high within the casing 2 to reach above the point where such hydraulic fluid is in excess of the strength of the casing 2, and the fluid 51 is placed between this tubing 41 and casing 2 up to near the upper end of the casing 2.

The device is then lowered into the well hole without removing the mud-laden fluid 52 except as such mud-laden fluid is displaced by the device with the addition of further sections of the casing 2 as the lowering process requires until the packing 8 is landed upon the upper end of the rat hole 50 so that such packing will shut off the mud-laden fluid 52 above said packing from the rat hole 50 therebelow. During the lowering of the testing device into the well hole, care should be taken to

agitate the mud-laden fluid within the well bore as little as possible in order to prevent the wall of the well hole from being washed down upon the testing device and freezing the same within the well hole.

The engagement of the packing 8 and top of the rat hole not only excludes the mud-laden fluid from the rat hole but anchors the valve body 20 in place. Thereafter the pipe or casing 2 may be rotated to open the valve 6 and the fluid in the rat hole will enter the screen section 12 of the inlet member 7 and ascend through the valve 6 in the testing device. When the pressure upon the fluids of the formation is sufficient, such fluid will continue to ascend through the casing 2 to the top of the well, and continuous production from the well may thus be had. Where the pressures on the formation 5 are insufficient for this purpose, the fluid will rise in the casing 2 to a height dependent upon such pressure. After the fluid has been permitted to enter the testing device for sufficient period of time to rise to a height to counterbalance the pressure upon the fluids in the formation 5, the casing 2 is again rotated to close the valve 6 after which such fluid is positively trapped in the device above the valve 6 and the device may be then removed from the well hole. As soon as the packer 8 is unseated from the top of the rat hole 50, the mud-laden fluid is reimposed upon the fluids within the formation 5, thereby preventing the further escape of such fluids. Upon the elevation of the device to the top of the well, the height of fluid in the testing device will indicate the pressure upon the fluids within the well and will permit a determination of the yield of such fluids which can be expected from such formation.

It is understood that during the removal of the device from the well, mud-laden fluid is added to the well bore to maintain the same filled so that the hydraulic pressure necessary to prevent the hole collapsing is at all times maintained within the well.

During the entrance of fluids from the formation 5 into the well testing device, such fluids contact with the impeller 17, rotating the screen cleaning device so that the star wheels 18 successively punch out each of the perforations in the screen section 12 of the inlet member, automatically maintaining such openings free.

While the device for testing wells herein described is well adapted for carrying out the objects of the present invention, it is understood that various modifications and changes in the details of the device may be made without departing from the present invention, and the present invention includes all such modifications and changes as come within the scope of the following claims.

RFL:LR

I claim:

[Written in margin]: McConnell Insert B1

1. An apparatus for testing the productivity of formations in a well comprising a conduit adapted to be lowered into a well to the formation, means swivelly carried by said conduit and adapted to be anchored in the well, a rotary valve for said conduit, and inter-engaging

)B1

gears carried by said ~~anchoring means~~ and conduit respectively, said gears being connected to actuate said valve.

2. An apparatus for testing the productivity of formations in a well, comprising an empty conduit adapted to be lowered into a well to the formation, a packer swivelly carried by said conduit, a rotary valve adjacent the lower end of said conduit, and inter-engaging gears connected to said conduit and said packer, said gears being adapted to operate said valve.

[Written in margin]: xB Insert B2

3. An apparatus for testing the productivity of formations in a well, comprising an empty conduit adapted

to the formation to be tested

to be lowered into said well$_\wedge$, a head attached to the lower end of said conduit, a valve body swivelly carried by said head, packing means carried by said body, inter-

)B2

engaging gears between said body and head, and a valve for closing the inlet to said conduit connected to be actuated by said gears.

[Written in margin]: Woods no invention Insert B3

4. A device for testing the productivity of formations encountered in a well, comprising a conduit adapted to be lowered to a well formation, a head carried by said conduit, a valve body swiveled to said conduit,)B3 ^ a valve carried by said body and adapted to be operated by relative movement between said head and valve body, and anti-friction bearing means between

157573 13

said body and head.

[Written in margin]: Per B Insert B4

5. An apparatus for testing the productivity of formations encountered in a well, comprising a conduit adapted to be lowered into a well ^ to the formation to be tested, means swivelly carried by said conduit adapted to be anchored in fixed rotary)B4 position in the well, a valve for said conduit adapted to be operated by relative rotation between said anchor means and said conduit, and anti-friction bearing means between said anchor means and said conduit.

[Written in margin]: Insert B5

6. An apparatus for testing the productivity of for-tions in a well comprising a conduit adapted to be low into the well to the formation, means swivelly carrie said conduit and adapted to be anchored in the we

rotary valve for said conduit, inter-connecting gears nected to said anchor means and said conduit adapte actuate said valve, and anti-friction bearing means tween said conduit and anchor means.

[Written in margin]: Insert B6

7. An apparatus for testing the productivity of for tions in a well comprising a conduit adapted to be low into a well to the formation, said conduit being cl from liquids within the well, a tube at the lower en said conduit adapted to enter a rat hole in the formal

a valve operative to establish communication between tube and said conduit, and gears connected to said and conduit adapted to actuate said valve by relative tion between the tube and conduit.

8. An apparatus for testing the productivity of for tions in a well comprising a conduit adapted to be l ered into a well to the formation, said conduit be closed from liquids

157573 1

[Written in margin]: B7

within the well, a tube at the lower end of said conduit adapted to enter a rat hole in the formation, a valve)B7 operative to establish communication between said tube and said conduit, gears connected to said tube and conduit adapted to actuate said valve by relative rotation between the tube and conduit, and anti-friction bearing means between said tube and conduit.

9. An apparatus for testing the productivity of formations in a well comprising a conduit adapted to be lowered into a well to the formation, said conduit being closed from liquids within the well, a tube at the lower end of said conduit adapted to enter a rat hole in the formation, a valve operative to establish communication between said tube and said conduit, and gears connected to said tube and conduit adapted to actuate said valve by relative rotation between the tube and conduit, said tube being connected with packing means adapted to engage the upper part of the rat hole and seal the formation from hydraulic pressure of liquid standing within the well.

10. An apparatus for testing the productivity of formations in a well comprising a conduit adapted to be lowered into a well to the formation, said conduit being closed from liquids within the well, a tube at the lower end of said conduit adapted to enter a rat hole in the formation, a valve operative to establish communication between said tube and said conduit, gears connected to said tube and conduit adapted to actuate said valve by relative rotation between the tube and conduit, and anti-friction bearing means between said tube and conduit, and tube being connected with packing means adapted to engage the upper part of the rat hole and seal the formation from hydraulic pressure of liquid standing within the well.

[Written in margin]: Aggregation

~~11. In an apparatus for testing the productivity~~ of ~~formation encountered in a well, means adapted~~ to ~~lowered into a well and provide an empty chamber~~ adj~~cent the formation to be tested, a valve adjacent~~ t~~lower end of said chamber for opening and closing~~ sa~~chamber, means for operating said valve from the~~ t~~of the well, a screen for the inlet to said conduit,~~ a~~means propelled by the fluid entering the conduit~~ f~~cleaning said screen.~~

[Written in margin]: Do 12 pr D

~~12. In an apparatus for testing the productivity~~ ~~a formation encountered in a well, means adapted~~ to ~~lowered into a well and provide an empty chamber~~ a~~jacent the formation to be tested, a valve adjacent~~ t~~lower end of said chamber for opening and closing~~ sa~~chamber, means for operating said valve from the~~ t~~of the well, a screen for the inlet to said conduit,~~ mea~~propelled by the fluid entering the conduit for~~ cleani~~said screen, and means for sealing the formation~~ fr~~the hydraulic pressure of the fluid standing within~~ t~~well.~~

[Written in margin]: Do 13

~~13. In an apparatus for testing the productivity~~ ~~a formation encountered in a well, means adapted~~ to ~~lowered into a well and provide an empty chamber~~ a~~jacent the formation to be tested, a valve adjacent~~ t~~lower end of said chamber for opening and closing~~ sa~~chamber, means for operating said valve from the~~ t~~of the well, a screen for the inlet to said conduit,~~ mea~~propelled by the fluid entering the conduit for~~ cleani~~said screen, means for sealing the formation~~ from t~~hydraulic pressure of the fluid standing within~~ the w~~and anti-friction bearing means swivelly connecting~~ sa~~packer and conduit.~~

157573 16

14. An apparatus for testing the productivity of a formation encountered in a well comprising a conduit adapted to be lowered into a well and provide an empty chamber adjacent the formation to be tested, a head for said conduit, a valve body swivelly connected to said head and provided with an inlet tube, gears connecting said head and body, a valve for closing said conduit actuated by said gears, and packing means adapted to engage the upper part of a rat hole in the formation.

[Written in margin]: Edwards? · Cavallaro 524666
166/10 ? tube is part of conduit in either case
Per C

~~15. A device for testing the productivity of a formation encountered in a well comprising a conduit adapted to be lowered into the well and provide a chamber adjacent the formation to be tested, a tube within said conduit at its lower end providing an annular fluid receiving space, a valve for the lower end of said conduit, packing means carried by said conduit, and means for operating said valve from the top of the well.~~

[Written in margin]: Per A

~~16. The screen described comprising a screen tube and a plurality of perforation cleaning members within the tube, and a fluid actuated propeller for operating said cleaning members.~~

~~17. The screen described comprising a casing having a pluarlity of apertures therein and a rotary aperture cleaning member, an eccentric shaft mounting said member, and a fluid operated impeller connected to said shaft.~~

~~18. A screen for a well conduit comprising a casing provided with a plurality of screening apertures, an eccentric shaft within said screen, a propeller connected to the shaft, and a perforating element carried by the eccentric shaft.~~

~~19. A screen for a well conduit comprising a casing provided with a plurality of screening apertures, an eccentric shaft within said screen, a propeller connected to the shaft, and a perforating wheel carried by the eccentric shaft.~~

[Written in margin]: Add D1

157573 18

Signed at Los Angeles, California, this 18 day of Dec 1926

Inventor sign full name: Erle P. Halliburton

OATH

STATE OF CALIFORNIA } ss.
COUNTY OF LOS ANGELES }

ERLE P. HALLIBURTON,

the above named petitioner, being duly sworn, deposes and says that he is a citizen of the United States, and resident of Los Angeles, California; that he verily believes himself to be the original, first and sole inventor or discover of the

WELL TESTING DEVICE,

described and claimed in the annexed specifications, that he does not know and does not believe that the same was ever known or used before his invention or discovery thereof, or patented or described in any printed publication in any country before his invention or discovery thereof, or more than two years prior to this application, or in public use or on sale in the United States for more than two years prior to this application; that said invention has not been patented in any country foreign to the United States on an application filed by him or his legal representatives or assigns more than twelve months prior

to this application; and that no application for patent on said invention has been filed by him or his legal representatives or assigns in any country foreign to the United States ~~except as follows:~~

Inventor sign full name:
Erle P. Halliburton

....

Subscribed and sworn to before me this 18 day of Dec, 1926

Margaret Bocode

(Impression) Notary Public in and for the County
(of Seal Here) of ~~Los~~ Angeles, State of California

157573 19

[Photostat—Figures 1, 2 and 3.]

157573 19½

[Photostat—Figures 4, 5, 6 and 7.]

157573 20

[These photostats appear at the end of this file wrapper.]

:. 38 . Room 145 60 JK/hm Paper No. 2-Rej.

DEPARTMENT OF COMMERCE
United States Patent Office
Washington

Address only
The Commissioner of
Patents, Washington,
C.," and not any official
by name

All communications
respecting this application
should give the serial
number, date of filing, and
name of the applicant

ase find below a communication from
EXAMINER in charge of this ap-
cation.

March 23, 1927

Thomas E. Robertson
Commissioner of Patents.

P O 11-8623

on & Lyon,
Nat'l City Bank Bldg.,
Angeles, Calif.

Applicant: Erle P. Halliburton
Ser. No. 157573
Filed Dec. 28, 1926
For Well Testing Device

[Stamped]: Patent Office
Mar 23 1927
Mailed

References made of record:

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Edwards	1,514,585	Nov. 4, 1924	166/1
MacCready	1,522,197	Jan. 6, 1925	166/21

series

Division is required between Claims (1) 1 to 10, 14 and (2) Claims 16 to 19 inclusive.

Claims 1 to 10 are drawn to a testing device whereas Claims 16 to 19 are drawn to a specific screen including an automatic cleaner and which is an independent invention.

Such claims as 11, 12, and 13 are rejected as aggregations in that they include independent inventions, since the testing device can readily operate without the specific screen, and the specific screen can be attached to any well or well pump tubing or filtering screen. There is no combination between the two devices since each operates independently, each performing its useful function without cooperating in any possible way.

All the claims are rejected on the requirement of division.

TK. C. F. Krafft,

Examiner.

157573 20 R

Serial No. 157573 Paper No. 3
Amendment A

[Stamped]:
Application Div.
May 27 1927
U. S. Patent Office

IN THE UNITED STATES PATENT OFFICE

[Stamped]:
U. S. Patent Office
May 28 1927
Division 18

Erle P. Halliburton, :
Ser. No. 157,573, : Application pending in
Filed Dec. 28, 1926, : Div. 38 – Room 145.
For Well Testing Device. :

The Honorable Commissioner of Patents,
Washington, D. C.

Sir:

Pursuant to Office Action of March 23, 1927, cancel claims 16 to 19 for the purpose of division.

REMARKS

Confirming the oral statement to the Examiner, applicant will arrange to be at the Patent Office on approximately the 15th of June to take up the merits of this application by oral interview. This invention has gone into extended successful use in the oil fields in Oklahoma, Texas, Louisiana, and Arkansas, and its success has attracted others to make unauthorized use of the invention

in competition with applicant. Applicant has a large investment and organization servicing wells by means of this invention and this business requires the early grant of a patent for protection. Applicant requests an action on the merits at the earliest date in order that the issues may be clearly defined at the time of the pending interview. A reconsideration of the rejection of claims 11 to 13 is rquested as applicant does not consider that there is no interdependence and cooperation between the testing device and the type of screen specified. The Examiner

157573 21 R

Erle P. Halliburton 157573 -2-

is requested to hold the rejection of claims 11 to 13 open until applicant can discuss the same at the interview.

Respectfully,

Lyon & Lyon
Attorneys for Applicant.

Washington, D. C.
May 27, 1927.

157573 22 R

Div. 38 Room 145 260 Paper No. 4

DEPARTMENT OF COMMERCE

JK/B United States Patent Office

Washington

Address only "The Commissioner of Patents, Washington, D. C.," and not any official by name

All communications respecting this application should give the serial number, date of filing, and name of the applicant

Please find below a communication from the EXAMINER in charge of this application.

June 7, 1927

Thomas E. Robertson
Commissioner of Patents

GPO 11-8623

Lyon & Lyon,
708 National City Bank Bldg.,
Los Angeles, California.

Applicant: Erle P. Halliburton

Ser. No. 157573
Filed Dec. 28, 1926
For Well Testing Device

[Stamped]:
Patent Office
June 7 – 1927
Mailed

In response to the amendment filed May 27, 1927.

Additional references made of record:

Woods 535,569 Mar. 12, 1895 166-2

Claims 1, 3, 4, 5, 6, 7 and 8 are rejected on McConnell, of record, who shows a device as defined by the claims. McConnell shows a conduit having a valve and another conduit swivelly carried by the first conduit, and the valve and conduit having inter-engaging means for actuating the valve to establish communication between the conduits. The device of McConnell, including all the elements recited in the claims, must be adapted for performing the functions attributed. By merely adding anti-friction means, applicant accomplished what an ordinary skilled mechanic could accomplish.

Such claims as 4 and 5 can be further rejected on Woods.

Claims 11, 12 and 13 are again rejected as aggregations. Applicant's specific screens can be used in any well device, and the screens do not cooperate in any way with the valve means beside the fact that each of them is useful in the place it is put and remains so independent whether the other part performs its function or not.

Claims 2, 9, 10 14 and 15 appear to be allowable.

TK. C. F. Kraft
Examiner.

157573 23

This Action Must Be Responded to Within Six Months.

R

Div. 38 Room 145 Paper No. 5

RAB/B

Address only "The Commissioner of Patents, Washington, D. C., and not any official by name

All communications respecting this application should give the serial number, date of filing, title of invention, and name of the applicant

DEPARTMENT OF THE INTERIOR
United States Patent Office
Washington July 13, 1927

Lyon & Lyon,
708 National City Bank Bldg.,
Los Angeles, California.

[Stamped]:
PatentOffice
Jul 13 1927
Mailed

Please find below a communication from the EXAMINER in charge of the application of

Erle P. Halliburton, Ser. No. 157573, Filed December 28, 1926,

For: Well Testing Device.

Thomas E. Robertson
Commissioner of Patents.

6—2681 G P O

The following claims are suggested to applicant for purpose of interference. Failure or refusal to make these claims on or before August 2, 1927 will be taken without

further action as a disclaimer of the invention cover thereby:

A method of testing the productivity of a formati encountered in a well containing drilling fluid, which i cludes lowering a sample chamber into the well throu the drilling fluid to the formation to be tested, the chamb being closed against the entrance of fluid from the w during the lowering operation, sealing off the well abo the formation to exclude the drilling fluid from the form tion, opening the chamber to permit cognate fluid fro the formation to enter the chamber, closing the chamb against the entrance of fluid from the well, releasing t seal and removing the chamber so closed to withdraw a entrapped sample of fluid from below the point at whic the well was sealed off.

A method of testing the productivity of a formatio encountered in a well containing drilling fluid, which i cludes lowering an empty string of pipe into the we through the drilling fluid to adjacent the formation, t pipe carrying a packer and having a valved inlet at i lower end which is closed while the pipe is being lowere setting the packer above the formation to seal off the dri ing fluid from the formation, opening the valved inl after the packer is set to permit cognate fluid from t formation to enter the pipe, closing the valved inl against the entrance of fluid from the well by moveme of the pipe, raising the pipe so closed to remove an e trapped sample and the packer from the well.

157573 24 R

= 157573--2

A method of testing the productivity of a formation encountered in a well containing drilling fluid involving the insertion of only a single string of pipe into the well to make a test, which includes lowering a test string into the well through the drilling fluid with a packer carried by the string and a valved inlet at the lower end of the string closed against the entrance of fluid from the well, setting the packer above the formation and opening the valve to permit cognate fluid from the formation to enter the inlet, closing the valve to prevent the subsequent entrance of fluid from the well through the inlet and releasing the packer, and raising the test string with the inlet closed against the entrance of fluid from the well to remove an entrapped sample of the packer.

Apparatus for testing a well comprising string of pipe to be lowered into a well having an inlet at its lower end and carrying a packing for sealing the well above the inlet, and a valve for the inlet positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

Apparatus for testing a well comprising a string of pipe to be lowered into the well, a packer carried by the pipe and means at the lower end of the pipe to receive a sample from the well including an inlet and a valve for controlling the inlet, the valve being positively controlled by movement of the pipe to open and close the inlet while the packer is seated.

Apparatus for testing a well containing drilling fluid. which includes an empty string of pipe to be lowered in

the well to adjacent the formation to be tested, means at the lower end of the pipe to receive a sample from the formation including an inlet opening into the pipe and a valve for controlling the inlet, and means carried by the pipe for sealing the well above the inlet, the valve being positively controlled by movement of the pipe.

Apparatus for testing a formation encountered in a well containing drilling fluid, which includes a single string of pipe to be lowered into the well to adjacent the formation to be tested, a valved inlet at the lower end of the pipe positively controlled from the top of the well by movement of the pipe and a packer carried by the pipe above the inlet.

Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, which includes an empty string of pipe to be lowered into the well to adjacent the formation to be tested, a packer carried by the pipe, means at the lower end of the pipe to receive a sample from the formation including an inlet opening into the pipe and a valve structure for controlling the inlet, the valve structure including a plurality of relatively movable parts one of which is secured to the pipe and another of which is connected to the packer.

Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, which includes a single empty string of pipe to be lowered into the well to adjacent the formation to be tested, means lowered into the well by said string of pipe for sealing off the drilling fluid from the formation to be tested, means at the lower end of said string of pipe to receive a sample from the formation including an inlet opening into said pipe

157573 25 R

and a valve structure for controlling the inlet, said valve structure including a part connected to said sealing means and a part connected to said pipe.

Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, comprising a single empty string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to be tested, a packer lowered into the well by said string of pipe for sealing off the drilling fluid from the formation to be tested, means at the lower end of said string of pipe to receive fluid from said formation including an inlet opening into said pipe below said packer and a valve structure for controlling the inlet, said valve structure having a relatively stationary part connected to the packer and a relatively movable part connected to the pipe.

Apparatus for testing the productivity of a formation encountered in a well containing drilling fluid, comprising a single empty string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to be tested, a packer carried by the pipe for sealing off the well above the formation an inlet below the packer opening into the pipe, and a valve for the inlet, the setting of the packer and the operation of the valve being positively controlled by movement of the pipe.

Apparatus for testing the productivity of a formation countered in a well containing drilling fluid, comprising string of pipe to be lowered into the well through the

drilling fluid to adjacent the formation to be tested, mean carried by the string of pipe to permit the flow of cognat fluid from the formation into the pipe, said means includ ing relatively movable parts having passages adapted to b brought into alignment to allow the fluid to flow into th pipe and brought out of alignment to retain the fluid in th pipe, and a packer mounted on one of said parts for seal ing off the drilling fluid from the formation while th passages are aligned.

Apparatus for testing the productivity of a formation in a well containing drilling fluid, comprising a string of pipe to be lowered into the well through the drilling fluid to adjacent the formation to receive a fluid sample therefrom and to be raised out of the well to remove the entrapped sample, said pipe being closed against the flow of drilling fluid as the pipe is lowered into the well, a packer carried by the pipe as the pipe is lowered into and removed from the well and adapted to be seated by manipulation of the pipe to seal off the well above the formation, an inlet to the pipe communicating with the wel below the point at which the packer seals off the well, and means for controlling the inlet to permit fluid from th formation to enter the pipe while the packer is set and t prevent fluid from entering the pipe after the packer i released and the pipe is being raised out of the well/

Apparatus for testing a well containing drilling fluid comprising a single string of pipe to be lowered into th well through the drilling fluid, said pipe being close against the entrance of the drilling fluid, means at th lower end of the pipe for receiving

157573 26 R

a sample including an inlet opening into the pipe, means carried by the pipe for sealing the well above the inlet, and a valve for the inlet that may be positively opened and closed by movement of the pipe while the well is sealed above the inlet.

B.

G. D. G. Nicolson,
Acting Examiner

[Stamped]: Mail Room Dec 5. 1927 U.S. Patent Office

[Stamped]: U. S. Patent Office Dec 6 - 1927 Division 38

Serial No. 157,573 Paper No. 6

Amendment B

IN THE UNITED STATES PATENT OFFICE

Erle P. Halliburton,)
)
WELL TESTING DEVICE,)
)
Serial No. 157,573,) Division 38, Room 145
Filed December 28, 1926.)

Los Angeles, California.
November 28, 1927.

Honorable Commissioner of Patents,
Washington, D. C.

Sir:

In response to the Office letter of June 7, 1927, we hereby amend as follows:

√Claim 1, line 4, after "well," insert —means carried thereby for sealing off the drilling fluid from the formation to be tested—.

B1

√Claim 3, line 3, after "well" insert—to the formation to be tested—; line 5, after "body" insert

B2 —for engaging the walls of the well and sealing off the formation from the hydraulic fluid in the well—.

√Claim 4, line 3, after "conduit," insert—means

B3 carried by the valve body adapted to pack against the walls of the well for sealing the formation to be tested from the hydraulic fluid thereabove and to anchor the valve body in fixed position—.

√Claim 5, line 3, after "well." insert—to the formation to be tested—; line 4, after "well," insert

B4 —packing means for so anchoring the same and for sealing off the formation to be tested from the hydraulic fluid in the well,—.

√Claim 6, line 4, after "well," insert —packing

B5 means for so anchoring the same and adapted for sealing off the formation to be tested from the hydraulic fluid in the well,—.

√Claim 7, line 5, after "formation," insert —pack-

B6 ing means adapted for sealing off the formation to be tested from the hydraulic drilling fluid in the well,—.

√Claim 8, line 5, after "formation," insert —pack-

B7 ing means adapted to seal the well above the inlet from the formation being tested—.

√Cancel claims 11 to 13 inclusive.

REMARKS

As amended, it is believed the Examiner will find the remaining claims allowable. The patent to McConnell clearly does not describe a device which will accomplish applicant's purpose. It merely shows a form of gear driven cock valve. The claims now each specify a means not disclosed in the reference for anchoring and packing or sealing off the apparatus from the drilling fluid in the well. Allowance of all of the claims is requested.

Respectfully submitted,

Lyon & Lyon
Attorneys for Applicant.

RFL:FMC

[Stamped]: Patent Office Jun 23 1928 Mailed

38 Room 145 260 RAB:MEA Paper No. 7

Address only
The Commissioner of Patents,
Washington, D. C.,"
and not any official by name

All communications respecting this application should give the serial number, date of filing, and name of the applicant

DEPARTMENT OF COMMERCE
United States Patent Office
Washington

Please find below a communication from the EXAMINER in charge of this application.

Thomas E. Robertson
GPO 11-8623 Commissioner of Patents.

June 23 1928

Applicant: Erle P. Halliburton

Ser. No. 157,573
Filed Dec. 28, 1926
For Well Testing Device.

Lyon & Lyon,
708 Natl. City Bnk Bldg.,
Los Angeles, Calif.

Responsive to amendment filed December 5, 1927.

Claim 15 appears to be directly readable on the patent to Edwards of record, and is thereon rejected.

The remaining claims are rejected on McConnell of record, in view of Edwards. Edwards shows the full broad combination in a testing device, including a valve embodied in a coupling member, which valve is operable from the top of the well when the coupling has been lowered therein, a drill stem connected to the upper end of the coupling and a packer and inlet connected to the lower end of the coupling member. McConnell discloses a valve, in the pipe connection of a fluid conduit, of the type disclosed and claimed by applicant. To attach a drill string to one end of said pipe connection or coupling, as in Edwards, and fix a packer to the opposite conduit section, as in Edwards, would not involve invention in view of said Edwards disclosure.

Applicant's claims are further rejected on the interference issue embodied in the claims which were suggested to applicant, in view of McConnell. Applicant's claims do not differ from that subject matter which he has disclaimed, except in the specific form of valve which is shown to be old in McConnell. A use of the McConnell valve in the organization set forth in the interfering claims would not amount to invention.

C. F. Krafft

B. Examiner.

157573 30 R

[Written at top]: #8 C
[Stamped]: Mail Division Dec. 20 28 U.S. Patent Office
[Stamped]: U. S. Patent Office Dec. 21 1928 Division 38

IN THE UNITED STATES PATENT OFFICE

In re application of)
)
ERLE P. HALLIBURTON)
)
WELL TESTING DEVICE) Division 38,
)
Filed December 28, 1926) Room 145
)
Serial No. 157,573)

Los Angeles, California
October 22, 1928

Honorable Commissioner of Patents,
Washington, D. C.
Sir:

In response to the office action of June 23, 1928, amendment is hereby made as follows:

√Cancel Claim 15.

REMARKS

Reconsideration of the rejection of the remaining claims on the references of record is requested.

Considering first the reference Edwards: this reference has been repeatedly explained to the Examiner as not embodying the combination of these claims. The claims suggested in this application by the letter of July 13, 1927, were allowed over the Edwards patent after a full discussion of the differences between the Edwards patent, and such Edwards patent discloses a device which has been established inoperative, for the reason

-1- 157573 31 R

set forth in the affidavits filed by Paul Paine and William A. Doble in Interference No. 55,940 and 55,941.

In said interference, the law examiner has rendered a decision sustaining the claims involved in that interference as patentable over the Edwards patent, excepting solely Count 1, which was so drawn as not to require the use of a single string of pipe carrying the valve and packer on a single testing string. Consistent with the views of the law examiner, and with his own views in allowing the claims forming the basis of that interference, it is thought that the examiner should withdraw the reference Edwards.

In connection with the rejection of the claims on the interference in issue plus McConnell, the following considerations, it is thought, should be applied. The device of McConnell does not relate to a testing apparatus and does not relate to an apparatus for use in the oil industry. These considerations are believed compelling when it is considered that it is necessary to combine this patent in order to make a supposed anticipation of the claims of this application. References from different arts should be combined with caution against the claims of an application.

As brought out in the references before mentioned, the conditions encountered in drilling and operating oil wells are peculiar and the success of an apparatus under the heavy hydraulic heads, gas pressure and other conditions in wells cannot be foreseen merely from its use on a hose nozzle. On a hose nozzle, the fluid

processed does not contain gas under tremendous pressure and the fluid processed does not contain sand and detritus which rapidly cut the parts and tend to work into the valve operating mechanism. Therefore, it is believed that the conditions of operation under which applicant's device is employed are sufficiently different in kind from the conditions of operation of the McConnell nozzle, that a new and different use can be said to have been developed which was not obvious to the art prior to the present invention.

Allowance of all of the claims is requested.

Respectfully submitted,

Lyon & Lyon
Attorneys for Applicant.

RFL-LS

157573 33 R

[Stamped]: Mailed Mar 6 1929

Div. 38 Room 345 260 Paper No. 9

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name

All communications respecting this application should give the serial number, date of filing, and name of the applicant

DEPARTMENT OF COMMERCE
United States Patent Office
Washington

Bry/d March 6, 1929

Please find below a communication from the EXAMINER in charge of this application.

Thomas E. Robertson

G P O 11-8623 Commissioner of Patents.

Applicant: E. P. Halliburton

Lyon & Lyon
708 Natl City Bank Bldg;
Los Angeles, Calif.

Ser. No. 157,573
Filed Dec. 28, 1926
For Well testing device

The following claim is suggested in accordance with Section 96, Rules of practice. Failure to make this claim within twenty days following the above date will be deemed a disclaimer of the subject matter.

In a well tester, the combination of a shell having a fluid inlet at the bottom, a valve controlling said inlet, a rotary member in the shell operatively connected to the valve and adapted to be connected to a string of tubing whereby it may be rotated to open and close the valve, and bearings in the shell, to support the weight of said member and the tubing connected thereto.

C. F. Krafft
Examiner.

B.

157573 34 R

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[Stamped]: Mail Division Mar 18 29 U.S. Patent Office

IN THE UNITED STATES PATENT OFFICE

ERLE P. HALLIBURTON)
)
WELL TESTING DEVICE)
) Division 38
)
Filed December 28, 1926) Room 345
Serial No. 157,573)

Los Angeles, California
March 11, 1929.

Hon Commissioner of Patents,
Washington, D. C.

Sir:

In response to the Office action of March 6, 1929, please add the following claim:

[In margin]: D1 per E.

~~20. In a well tester, the combination of a shell having a fluid inlet at the bottom, a valve controlling said inlet, a rotary member in the shell operatively connected to the valve and adapted to be connected to a string of tubing whereby it may be rotated to open and close the valve, and bearings in the shell, to support the weight of said member and the tubing connected thereto.~~

Respectfully submitted,

Lyon & Lyon
Attorneys for Applicant.

RFL-LS

157573 35 R

INTERFERENCE.

"A"

Interference No. 58328 Paper No. 11

Name, Erle P. Halliburton

Serial No. 157,573

Title, Well testing device

Filed, Dec. 28, 1926

Interference with Conner, Powell, Lewis

DECISIONS OF

Law Examiner, Interferences dissolved Dated, Jun 9 1930

Ex'r of Interferences, ... Dated, ...

Board, ... Dated, ...

Commissioner, ... Dated, ...

REMARKS:

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

6 - 1970

157573 36 R

Stamped]: U. S. Patent Office Interference Div. May 22 1929 Mailed

Div. 38 Room 145 213 Paper No. 12

Address only
The Commissioner of Patents,
Washington, D. C.,"
and not any official by name

All communications respecting this application should give the serial number, date of filing, and name of the applicant

Bry/d

DEPARTMENT OF COMMERCE
United States Patent Office
Washington

M GPO 11—8035

Please find below a communication from the
EXAMINER in charge of this application "A"

Thomas E. Robertson
Commissioner of Patents

Applicant: E. P. Halliburton

Ser. No. 157,573
Filed............Dec. 28, 1926
For..............Well testing device

Lyon & Lyon
Natl City Bank Bldg;
Los Angeles, Calif.

The case, above referred to, is forwarded to the Examiner of Interferences because it is adjudged to interfere with others, hereafter specified. The question of priority will be determined in conformity with the Rules. The interference will be identified as No. 58328 On or before 19 1929 the statement demanded by rule 110 must

be sealed up and filed with the subject of invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

Count 1

In a well tester, the combination of a shell having a fluid inlet at the bottom, a valve controlling said inlet, a rotary member in the shell operatively connected to the valve and adapted to be connected to a string of tubing whereby it may be rotated to open and close the valve, and bearings in the shell, to support the weight of said member and the tubing connected thereto.

The interference involves your application above identified and an application filed by Julian B. Conner for: Flow Tester. Mr. Conner's address is Box 115, Humble, Harris Co; Texas, his attorneys are Hardway & Cathey, Bankers Mortgage Bldg; Houston, TEX., and an application filed by Guy V. Lewis for: Well Testing Device. Mr. Lewis's address is, 1213 Matamoros St; Laredo, TEX., his attorney is J. R. Stone, Union Ntl Bank Bldg; Houston, TEX., and an application filed by Mr. Ernest Powell for: Well tester. Mr. Powell's address is Von Ormy, TEX., his attorney is J. R. Stone, Union Ntl Bank Bldg; Houston, TEX.

The relation of the count of the interference to the claim of the respective parties is as follows:

Count	Conner	Powell	Lewis	Halliburton
1	15	24	24	20

C. F. Krafft Examiner, Division 38.

B.

(Counts compared)

157573 37 R

INTERFERENCE

"B"

Interference No. 58329 Paper No. ~~11~~ 13

Name, Erle P. Halliburton

Serial No. 157,573

Title, Well testing device

Filed, Dec. 28, 1926

Interference with Biggs, Powell, Lewis

DECISIONS ON MOTION

Law Examiner, Interference dissolved as to Biggs
Dated, Mar 6 - 1930

Board of Appeals, ... Dated, ...

DECISIONS ON PRIORITY

Ex'r of Interferences, Favorable Dated, Oct. 20/30

Board of Appeals, ... Dated, ...

Court, ... Dated, ...

REMARKS:

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

157573 . 38 R

[Stamped]: U. S. Patent Office Interference Div. May 22 1929 Mailed

~~12~~.

Div. 38 Room 145 213 Paper No. 14

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name

All communications respecting this application should give the serial number, date of filing, and name of the applicant

DEPARTMENT OF COMMERCE
United States Patent Office
Washington

Bry/d GPO 11—8035

Please find below a communication from the

EXAMINER in charge of this application "B"

Thomas E. Robertson
Commissioner of Patents

Applicant: Erle P. Halliburton

Lyon & Lyon
Ntl City Bank Bldg;
Los Angeles, Calif.

Serial No.......157,573
Filed..........Well testing device
For................Dec. 26, 1926

The case, above referred to, is forwarded to the Examiner of Interferences because it is adjudged to interfere with others, hereafter specified. The question of priority will be determined in conformity with the Rules. The interference will be identified as No. 58329 On or before Jul 9 1920 the statement demanded by rule 110 must be sealed up and filed with the subject of invention, and name

of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

Count 1

A device for testing the productivity of formations encountered in a well, comprising a conduit adapted to be lowered to a well formation, a head carried by said conduit, a valve body swivelled to said conduit, means carried by the valve body adapted to pack against the walls of the well for sealing the formation to be tested from the hydraulic fluid thereabove and to anchor the valve body in fixed position, a valve carried by said body and adapted to be operated by relative movement between said head and valve body, and antifriction bearing means between said body and head.

The interference involves your application above identified and an application filed by Basil B. Biggs, Jennings, Louisiana, for Well Testers; whose attorney is Browne & Phelps, 2nd Natl. Bank Bldg; Wash; D. C., and an application for Well Tester filed by Ernest Powell, Box 56A, Route 1, Von Orma, Texas, whose attorney is J. R. Stone, Union Natl. Bank Bldg; Houston, TEX; and an application for Well Testing Device filed by Guy V. Lewis, 1213 Matamoras St; Laredo, Texas, whose attorney is J. R. Stone, Union Natl. Bank Bldg; Houston, Texas.

The relation of the count of the interference to the claims of the respective parties is as follows:

Count:—	Biggs	Lewis	Powell	Halliburton
1	9	15	25	4

C. F. Krafft
Examiner, Division 38.

B.

157573 39 R

INTERFERENCE

Interference No. 58331 Paper No.

Name, Erle P. Halliburton

Serial No. 157,573

Title, Well testing device

Filed, Dec. 28, 1926

Interference with Lewis, Powell

DECISIONS ON MOTION

Law Examiner, ... Dated, ...

Board of Appeals, ... Dated, ...

DECISIONS ON PRIORITY

Ex'r of Interferences, Favorable Dated, Nov. 11 2

Board of Appeals, ... Dated, ...

Court, ... Dated, ...

REMARKS:

This should be placed in each application or patent volved in interference in addition to the interference lett by Primary Examiner.

157573 40 I

[Stamped]: U. S. Patent Office Interference Div. May 22 1929 Mailed

Div. 38 Room 145 213 Paper No. 16

Address only "The Commissioner of Patents, Washington, D. C.," and not any official by name

Bry/d

All communications respecting this application should give the serial number, date of filing, and name of the applicant

DEPARTMENT OF COMMERCE
United States Patent Office
Washington

Please find below a communication from the

EXAMINER in charge of this application "D"

Thomas E. Robertson
Commissioner of Patents

Applicant: Erle P. Halliburton

Lyon & Lyon
708 Natl City Bank Bldg;
Los Angeles, Calif.

Serial No.......157,573
Filed...............Dec. 28, 1926
For.............Well testing device

The case, above referred to, is forwarded to the Examiner of Interferences because it is adjudged to interfere with others, hereafter specified. The question of priority will be determined in conformity with the Rules. The interference will be identified as No. 58331 On or before Jul 9 1929 the statement demanded by rule 110 must be

sealed up and filed with the subject of invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

Count

An apparatus for testing the productivity of formations encountered in a well, comprising a conduit adapted to be lowered into a well/to the formation to be tested, means swivelly carried by said conduit adapted to be anchored in fixed rotary position in the well, packing means for so anchoring the same and for sealing off the formation to be tested from the hydraulic fluid in the well, a valve for said conduit adapted to be operated by relative rotation between said anchor means and said conduit, and anti-friction bearing means between said anchor means and said conduit.

The interference involves your application above identified and an application for Well testing device, filed by Guy V. Lewis, 1213 Matamoros St; Laredo, Texas, whose attorney is Jesse R. Stone, Union Natl Bank Bldg; Houston, Texas, and an application filed by Ernest Powell, Box #56A, Route 1, Von Orma, Texas for: Well tester, whose attorney is Jesse R. Stone, Union Natl Bank Bldg; Houston, Texas.

The relation of the counts of the interference to the claims of the respective parties is as follows:

Count	Lewis	Powell	Halliburton
1	16	26	5

C. F. Krafft Examiner, Division 38

B.

[Stamped]: Mailed Oct 28 1930

Div. 38 Room 145 260 Paper No. 17

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE
WASHINGTON

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name
kh/d

All communications respecting this application should give the serial number, date of filing, and name of the applicant

Please find below a communication from the EXAMINER in charge of this application.

Thomas E. Robertson

GPO 11—8623 Commissioner of Patents.

Applicant: E. P. Halliburton
157,573

Lyon & Lyon
Ntl City Bank Bldg:
Los Angeles, Calif.

Ser. No. 12/28/26
Filed
For — Well testing device

Additional references made of record:

	Franklin	263,330	Aug. 29, 1882	166/1
(Brit)	Simmons (Ish)	279,175	Oct. 24, 1927	"

The interference #58,328 involving claim 20 having been dissolved on the ground that the count thereof is not patentable in view of the patent to Franklin and the time

for the appeal having expired, claim 20 stands finally rejected.

Claims 1 to 3, 6 to 10 and 14 are rejected as not defining invention over the issue of the proposed claims which applicant failed to make and shown by the British patent to Simmons; over the issue of the interference #58,328; over the patent to Simmons; over the patent to Franklin; in view of the specific valves disclosed by the patent to McConnell.

Applicant's argument as to the impropriety of the combination of the well testing devices with McConnell's valve have been given consideration but it is not thought the adaption of one type of a rotary valve for another, both types of valves being known, amounts to invention. The Simmons and Franklin patents disclose devices which are used for well testing and the lower part has a packer which anchors the device in the well whereby the rotation of the upper string operates some rotary valve and it may well be the type of the valve shown by McConnell. Applicant's argument of November 28, 1927 stating that McConnell does not describe a device which will accomplish applicant's purpose is immaterial and irrelevant because the claims were not rejected on this patent but on such other patents which will accomplish what applicant accomplishes. The valve to McConnell when substituted in these

devices will accomplish everything applicant's valve accomplishes, being the same kind of a valve. Such claims as 6 and some others which include antifriction bearings fail to distinguish from the references because the provision of ball and race bearings for relatively rotary parts is a frequent way of ordinary workmanship such bearings merely helping the relative rotation of the parts and the provision thereof does not involve invention.

Claims 4 and 5 which were involved in interferences and were decided favorably to the applicant are rejected as failing to define invention over Franklin in merely providing antifriction means between the relatively rotatable parts. Attention of the applicant is called to the fact that the Franklin patent in the motion made in the interference #58,328 has been considered to be a testing tool. The Law Examiner granted the motion and ordered the interference dissolved and applicant did not appeal the decision of the Law Examiner.

The claim is further therefore rejected as not defining invention over the issue involved in the interference #58,328 in merely including antifriction bearings.

It is not thought this case contains patentable matter and applicant should prepare the case for final action.

C. F. Krafft
Examiner

F.K.

B - #18 E.
21/158

[Stamped]: Mail Division Apr 18 31 U.S. Patent Office
[Stamped]: U. S. Patent Office Apr 21 1931 Division 38

IN THE UNITED STATES PATENT OFFICE

ERLE P. HALLIBURTON,)
WELL TESTING DEVICE,) Div. 38, Room 145
Filed Dec. 28, 1926,)
Ser. No. 157,573.)

Los Angeles, Calif.,
April 11, 1931.

Hon. Commissioner of Patents,
Washington, D C.

Sir:—

In response to the Office action of October 28, 1930, please amend as follows:—

Cancel claim 20.

REMARKS

Reconsideration of the rejection of the remaining claims is requested. Before discussing the claims in detail, a short history of the invention and of the prosecution of this application and a companion application in the Patent Office will be helpful to the Examiner.

Applicant in this application is the assignee of Simmons application, Ser. No. 87,323, filed February 10, 1926. The Simmons application is substantially identical with the British Simmons patent No. 279,175, issued October 24, 1927, which is cited as a reference against this application. While the British patent is not a statutory bar because it issued later than the filing date of this application,

157573 44 R

Halliburton, Ser. 157,573.

nevertheless we have no objection, in the prosecution of this case, to the Examiner considering the disclosure of the Simmons British patent, because admittedly that invention is prior to the invention of this application which applicant has always admitted, as shown by his refusal to make the claims suggested in the letter of July 13, 1927, which were taken out of the Simmons application.

The Simmons patent, as established in Interferences Nos. 55,940, 55,941 and 59,515 – in which interferences such Simmons application was involved, discloses the first process and apparatus which could be successfully used in oil wells for taking samples of oil and gas from formations. As shown in the British patent, the original Simmons invention used as a valve two parts 4 and 19, as shown in Fig. 4, which had passages 17 and 18 and 5 and 6 which were intended to be aligned by rotating them into the aligning position. Between parts 4 and 19 there was a ground fit.

This device in operation, while it worked successfully, had the disadvantage that the ground fit between parts 14 and 19 would stick, requiring careful manipulation of the pipe to take some of the weight of the pipe off the part 4. After operating in the early part of 1926 with the Simmons form of tester, the invention of this application was devised in which the ball race 27 is supplied and a plug cock valve 6. These parts were all provided in the apparatus in such a manner as to be protected from fluid in the well. It should be appreciated that

inside of the pipe 2 of the Halliburton apparatus there is no liquid when the device is being lowered into the well, yet outside of the pipe and surrounding the parts housing the ball race and valve liquid pressures exist inasmuch as the device may be lowered 5,000 feet or more below the liquid level in the well. The design and arrangement of a valve and bearing, therefore, which could operate satisfactorily under these severe conditions was a matter requiring a large amount of study and experimentation.

The Simmons application no sooner was allowed by the Examiner than it was thrown into two interferences, involving eight other parties, each of which other parties learned of the invention through public use of the Simmons application, and the admitted purpose of these parties in securing interferences in the Patent Office were merely to harass Halliburton in securing allowance of the Simmons application by bringing motions to dissolve the interferences on the ground that the claims were not patentable.

The references set up were substantially the same as considered by the Examiner in allowing the Simmons application. A decision was entered in these interferences finding the claims of the Simmons application patentable. No sooner had such interference been declared, than a second interference was declared between Simmons' application and the application of another party, who had throughout the prosecution of the earlier interferences been merely standing by to await their outcome. This second party brought another motion to dissolve, setting up the same patents as before and adding the Franklin patent, which is the patent relied upon by the Examiner in this application in his rejection of said claims.

e have always understood it to be the rule in the nt Office that where the claims of an application have been found allowable by one Examiner they should be rejected by another Examiner on the same refers or on any other references, unless the anticipation ee from all possible doubt.

evertheless, in this second interference, the Law niner rendered a decision finding all of the claims of Simmons application unpatentable and without even ioning the prior decision of the previous Law niner.

n appeal was taken from this decision to the Board ppeals in record time, who promptly reversed this den and sustained the patentability of the Simmons aption, and very clearly and definitely ~~disposed of the~~ klin patent as an anticipation. This decision of the d was rendered February 18, 1931.

ith respect to the Franklin patent the Board stated –

'he apparatus claims 2-10 and 12 have been held untable in view of the disclosure in the Franklin patent dered in connection with Macready. The Franklin nt discloses a device for regulating or controlling the of oil wells. It consists of a valve structure shown igs. 1 and 2 which is intended to be attached to the g of the well preferably above the packer. When ubing is placed in the well or is withdrawn from it alve disk may be closed ~~by turning~~ the upper part of ubing and thus prevent flowing of oil. The Examiof Interferences holds that the lower part of the valve ture, namely part B, could be used as a packer to fit at hole in view of Macready 1,522,197 and thus antithese counts. We are unable to

take this view. The Franklin patent was not designed to have the part B serve the function of a packer. The part B happens to be somewhat tapered, but otherwise there is no suggestion that it could be used as a packer. Nor do we think that the Macready patent would supply what the Franklin patent lacks. We have noted the statements concerning the Franklin patent made by Judge Hutcheson in his decision involving the Edwards patent. However, the general statement made that the device of Franklin could be modified to be used as a tester gives no clue as to what modifications were contemplated.

* * * * *

"The Franklin structure was devised years before any packers were used and it was never intended to function as a tester when it was constructed."

It is, therefore, clear from the decision of the Board that the Franklin patent was not intended for testing oil wells, but was an apparatus for regulating the flow of oil wells, and, second, that there is no packer in the Franklin device and the addition of parts from other patents to the Franklin device for making out of the Franklin device a well-testing apparatus is not a legitimate manner of anticipating an invention. It is, of course, well settled that an anticipation cannot be made out of ideas extracted from different patents, when no one of the patents shows the combination claim.

We think this decision of the Board of Appeals should also be considered as one condemning the rejection of claims which have already been allowed and thoroughly considered by other Examiners in cases like the present, where a plurality of patents must be aggregated together and, therefore, anticipation is certainly far from clear.

Halliburton, Ser. 157,573.

During the pendency of the Simmons interferences, the Patent Office has proceeded to grant numerous patents to subsequent applicants, including practically all of the applicants who contested such Simmons interferences, on detailed improvement devices, consisting merely in the substitution of spring valves and like things in the Simmons apparatus. At least twenty of such patents have been granted and the names and numbers of them can be furnished if desired. Patents have issued to Johnson, to Neitzel, and many others, yet the present Halliburton application has been very rigidly scrutinized by the Patent Office and was very thoroughly considered before any of the claims were allowed and before interferences Nos. 58,329 and 58,328 were declared. As soon as these interferences were declared, the usual flood of motions to dissolve appeared.

In Interference No. 58,329 a motion was brought to dissolve claim 20 on the ground that such claim was not patentable over patents to Franklin and Edwards. These were the same two patents that were considered in the prior Simmons interferences. There is a great number of reasons that Edwards is not an anticipation, which are unnecessary to consider here.

We have shown that the Franklin patent does not disclose a testing apparatus or process for testing wells, nevertheless claim 20 being an apparatus claim must contain apparatus limitations therein distinguishing from Franklin's apparatus, or it is not patentable. The chief missing element in the Franklin apparatus which

Halliburton, Ser. 157,573.

prohibits its use as a well tester is the absence of a proper packer. Claim 20 contained no such packer. Recognizing, therefore, that claim 20, which has originated from another party's application, was not in proper form and was not patentable over Franklin, even if Franklin did not disclose a well tester, the party Halliburton joined, in effect, in this motion to dissolve and pointed out clearly and specifically to the Law Examiner wherein claim 20 was not patentable. Accordingly, the Law Examiner rendered a decision, in which he stated –

"The count does not recite a packer, and it is, therefore, unnecessary to find an equivalent of a packer in the Franklin patent. The count does not specify that the bearings are independent of the valve structure."

From this history of the Halliburton application, it appears quite clear that applicant is not debarred from urging that Franklin's is not a well testing apparatus, and the Board of Appeals has confirmed applicant's contention in this respect. The Examiner in rejection of claims 4 and 5 tries to, in effect, say that applicant, Halliburton, is, by the decision of the Examiner which found such claims patentable, debarred from urging that they are patentable, merely because with respect to another claim, which is clearly distinguishable, Halliburton has agreed that such claim is not patentable and, in fact, assisted in getting the Examiner to rule that it was not patentable.

Concluding our consideration of the history of these applications, we, therefore, find as follows:–

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(1) That these patents to Franklin and Simmons have been thoroughly considered, and that it has been definitely ruled that the Franklin patent does not diselose an apparatus capable of a well tester;

(2) That the Franklin patent does not disclose any packer; and

(3) That it is is improper to aggregate with the Franklin patent other patents showing valves, packers, etc., to make an anticipation of a well testing device.

Now, the claims here rejected have first been found allowable by the Examiner who caused Interferences Nos. 58,328 and 58,329 to be declared, and the patentability of the claims had been sustained by the decision of the Law Examiners in those interferences.

In the meanwhile, the Patent Office has granted to the parties who have been engaged in merely harassing Halliburton and Simmons a large number of patents on different forms of valve structures to be used in well testing apparatuses. We think it is now time that the Patent Office should accord to Halliburton some degree of fair treatment. The persistence of the Examiners in rejecting Halliburton's application, quite without regard to how many other times the same claims may have been allowed and found patentable by other Examiners over the same references, is not quite understandable. It is quite inconsistent with the action of the Patent Office on other applications for like devices.

McConnell's valve structure has nothing to do with the well testing device. The modification of the

Halliburton, Ser. 157,573.

Franklin patent by other patents, such as McConnell, to make out a supposed anticipation is the same form of rejection that was condemned by the Board in its decision in the Simmons interferences. The Simmons application fails to disclose how a valve may be protected from fluid pressure in a well testing device. It provides a device which has the disadvantage that it will stick in operation. It clearly is not an anticipation of the improvements in the specific claims of this application.

With regard to the question of the bearings specified in the claims, attention is called to the fact that the claims are restricted to particular bearings disposed in particular places and having particular effects. This is emphasized by the proceedings in Interference No. 58,329. In that interference, the party Biggs moved to dissolve the interferences as to his disclosure, because his disclosure did not correspond to the count, which was present claim 4 of this application. Biggs contended –

"3rd. That the count of the issue does not read on his disclosure since the anti-friction bearing therein disclosed does not act and is not located between an element responding to the 'valve body' of the claim and an element responding to the recited 'head carried by the conduit' or any other 'head', and that the anti-friction bearing of his disclosure has a totally different function from the corresponding elements in the structures of the other parties, particularly Halliburton in whose file the claim originated."

This limited construction of claim 4 was acquiesced in by Halliburton, who, before the Law Examiner, stated -

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"We agree that Biggs' disclosure does not include the anti-friction bearing means required in the count. While there is located a bearing in the Biggs device, it is not related as required in the count."

Therefore, the Examiner's contention that there is nothing patentable in the claims calling for anti-friction bearings is uncalled for, that the use of bearings is common and has nothing to do with the subject matter of this application. The claims are for a specific use of anti-friction bearings having specific functions. This, and the obvious rule that it is not proper to aggregate together references, no one of which discloses a device capable of the general function of applicant's invention, clearly is sufficient warrant for allowing all of the claims in this application.

In conclusion, we respectfully submit that in the examination of this application the Examiner has followed an unusually vigorous process of repeatedly rejecting claims on grounds which are not proper and which have been thoroughly considered before. The subject matter of the claims of this application has, in effect, been found patentable in numerous instances. We cannot explain to our client why, after all these interferences and all these decisions deciding that claims of this scope are patentable, we should have to further argue the matter. Settled rules of the Patent Office require that these claims be allowed, unless an anticipation can be found which is entirely free from any question of doubt. The

Halliburton, Ser. 157,573.

attempted anticipation sought in this case has been expressly ruled against, in form at least, by the Board of Appeals in the Simmons interference. We ask for a final action.

Respectfully submitted,

Lyon & Lyon
Attorneys for Applicant.

RFL:FE

Div. 38 Room 145 JK:FIS Paper No. 19

DEPARTMENT OF COMMERCE
United States Patent Office
Washington Final Rejection

Address only "The Commissioner of Patents, Washington, D. C.," and not any official by name	All communications respecting this application should give the serial number, date of filing, and name of the applicant

[Stamped]: Mailed Apr 24 1931

Please find below a communication from the EXAMINER in charge of this application.

Thomas E. Robertson
GPO 11-8623 Commissioner of Patents.

Applicant: Erle P. Halliburton

Lyon & Lyon
708 Nat'l. City Bank Bldg.
Los Angeles, Calif.

Ser. No. 157,573
Filed Dec. 28, 1926
For Well Testing Device

Responsive to amendment filed April 18, 1931.

The rejection of claims 1 to 10 and 14 on the references and for reasons of record is repeated.

Applicant's argument has been given a careful consideration and it is not seen that it has merit. The patent to Simmons is a complete reference against the application because applicant refused to enter any interference with the domestic application to Simmons Applicant failed to appeal against the decision of the Law Examiner which held the Franklin patent to be a well tester and applicant is estopped from asserting it now even if in some other

case acting as an assignee he did appeal a decision of the Law Examiner. Furthermore, Franklyn may not be a reference against the Simmons patent but it may become a reference against a later filed application in view of the teachings of Simmons.

The Examiner takes issue with counsel that the rejections of these claims were or are improper or that the previously allowed claims were rejected after allowance thereof without citing new art, or that the patent to Franklyn discovered by one of the interfering parties is not relevant, or that invention would be involved in using the Franklyn device in a manner Simmons uses his even if the claims of Simmons could not have been rejected on Franklyn, or that the changes made in Simmons or Franklyn involve invention in view of ~~the specific~~ valve shown by Connor;

or that other patents were allowed for the same invention as applicant's or that this case has been treated with prejudice as it appears from counsel's argument.

The issues involved are clear and this rejection is made final. An appeal therefrom lies to the Board of Appeals.

TK

C. F. Krafft
Examiner.

Paper # 20,

IN THE
DISTRICT COURT OF THE UNITED STATES
FOR THE EASTERN DISTRICT OF TEXAS
TYLER DIVISION

. . . .

ERLE P. HALLIBURTON and HALLIBURTON OIL WELL CEMENTING COMPANY, a corporation, Plaintiffs,	
- vs. -	IN EQUITY NO. 693.
JOHNSTON FORMATION TESTING CORPORATION, a corporation, and E. C. JOHNSTON, Defendants.	

ON THIS THE 12th day of June, A. D. 1934, came on to be heard the application of defendants in the above entitled and numbered cause for an order of court granting to the said defendants right of access to the archives of the United States Patent Office for inspection and for the procuring of certified copies of documents;

AND IT APPEARING UNTO THE COURT that the above entitled and numbered cause is a suit for alleged infringement of United States Letters Patent No. 1,930,987, issued on October 17th, 1933, to Erle P. Halliburton, as assignee of John T. Simmons, for "Method and Apparatus for Testing the Productivity of Formations Encountered in Wells"; and the Court, having considered the application of the defendants and the affidavit in support thereof to the effect that certain records and documents in the United States Patent Office are material to the defense in this cause, which material records are as follows:

(a) The file wrapper of United States Letters Patent No. 1,930,987, patent applied for by John T. Simmons on February 10th, 1926, in which patent was issued on October 17th, 1933, to Erle P. Halliburton, assignee of John T. Simmons; and

(b) The file wrapper of the Halliburton Stop Cock and Gear Tool Application, Serial No. 157,573, the filing date of which is unknown to defendants, but which was about 1926 or 1927;

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THE COURT FINDS that said defendants, JOHNSTON FORMATION TESTING CORPORATION, a corporation, and E. C. JOHNSTON, have a legitimate interest in the said papers and documents described above, which may have a material bearing upon the issues to be litigated in this cause, and finds that it is proper that the said defendants shall have access to the said file wrappers and contents thereof, and should be allowed to secure copies of the said file wrappers and the contents thereof, or any part thereof, upon the payment of the usual and customary fees of the United States Patent Office; and the Commissioner of Patents is accordingly directed to give such access and furnish such documents upon the payment of said customary fees by the defendants, or either of them.

Randolph Bryant

UNITED STATES DISTRICT JUDGE

Approved June 15, 1934

D. E. Wilson

Chief Manuscript and Photoueragraph Division.

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Certified Copy D. C. Form No. 30

UNITED STATES OF AMERICA
} ss:
Eastern DISTRICT OF Texas

I, F. A. King, Clerk of the United States District Court in and for the Eastern District of Texas, do hereby certify that the annexed and foregoing is a true and full copy of the original Order allowing defendants access to specified records of the United States Patent office in the case of Erle P. Halliburton and Halliburton Oil Well Cementing Company, a corporation vs. Johnston Formation Testing Corporation, a corporation, and E. C. Johnston, No. 693 In Equity, Tyler Division.

now remaining among the records of the said Court in my office.

IN TESTIMONY WHEREOF, I have hereunto subscribed my name and affixed the seal of the aforesaid Court at Sherman, Texas this 12th day of June, A. D. 1934

F. A. King

Clerk.

By B Edwards Jr.

Deputy Clerk.

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1926

CONTENTS:

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Government Printing Office

[Stamped]: U. S. Patent Office Date Division

Serial No. 157573 DIV. 38.

2 Sheets Sheet 1

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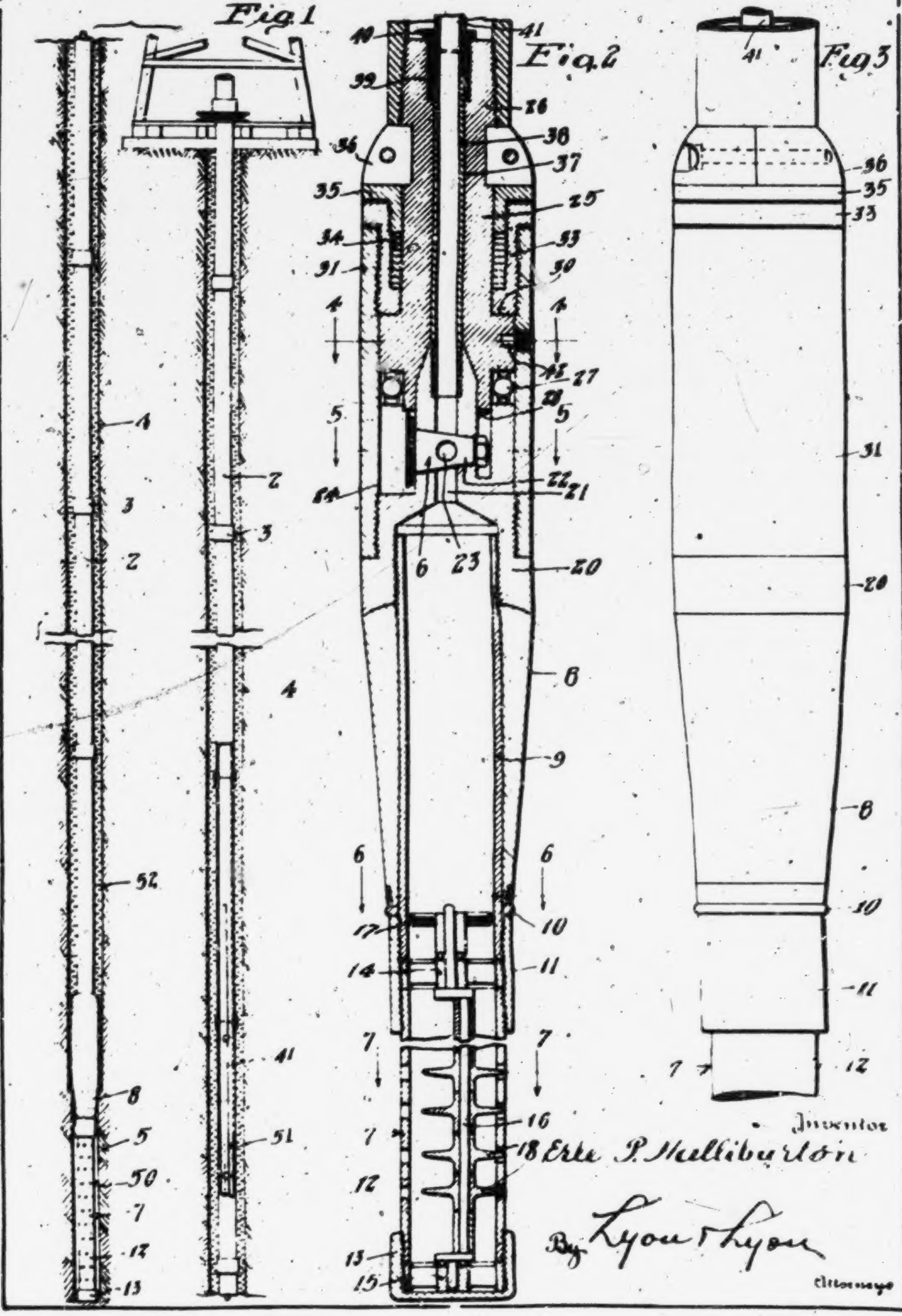


Inventor

Erle P. Halliburton

By Lyon & Lyon

Attorneys

DIV 38

Serial No 157573

2 Sheets Sheet 2

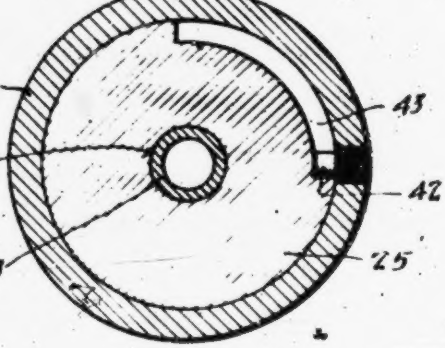
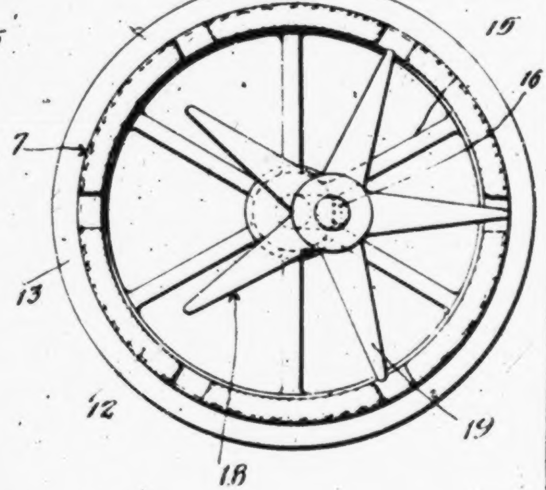


Fig. 4

Fig. 7



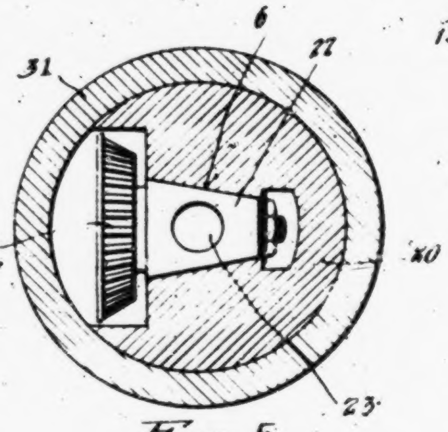


Fig. 5

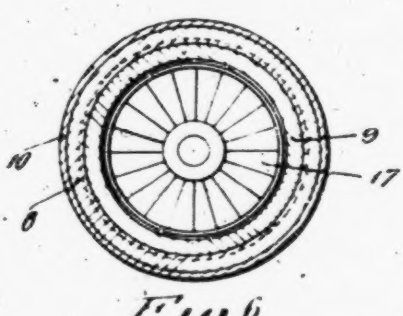


Fig. 6

Inventor

Erle P. Halliburton

By Lyon & Lyon

Attorneys

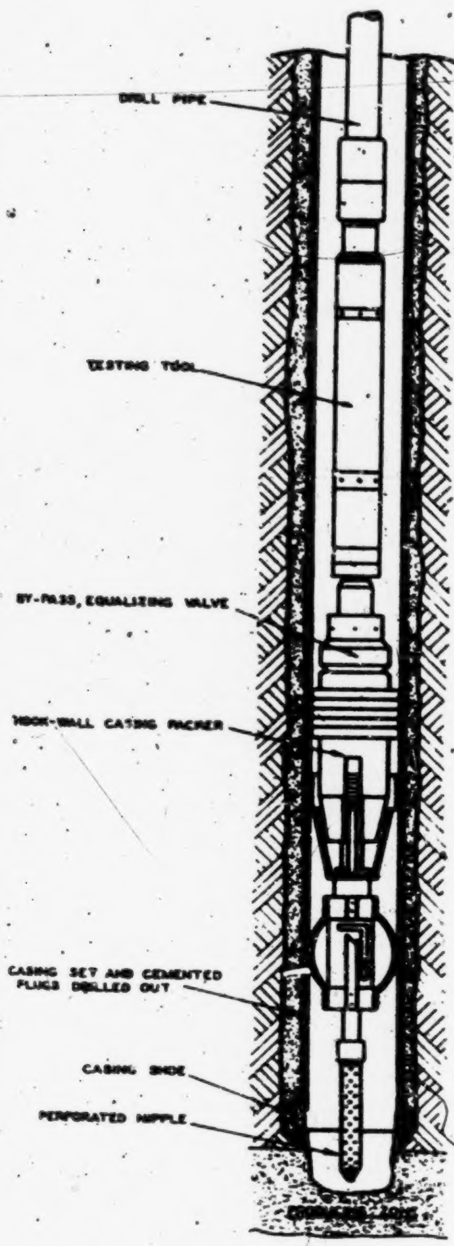
(Photostats.)

[Stamped on Back]: Assembled by P. B. Revised by ....Letter No. James M. Abbett Date 10/2/35 No. D-56- Halliburton vs. Honolulu Deft EXHIBIT No. A Filed 11/11 1935 R. S. ZIMMERMAN, Clerk By Cross Deputy Clerk.

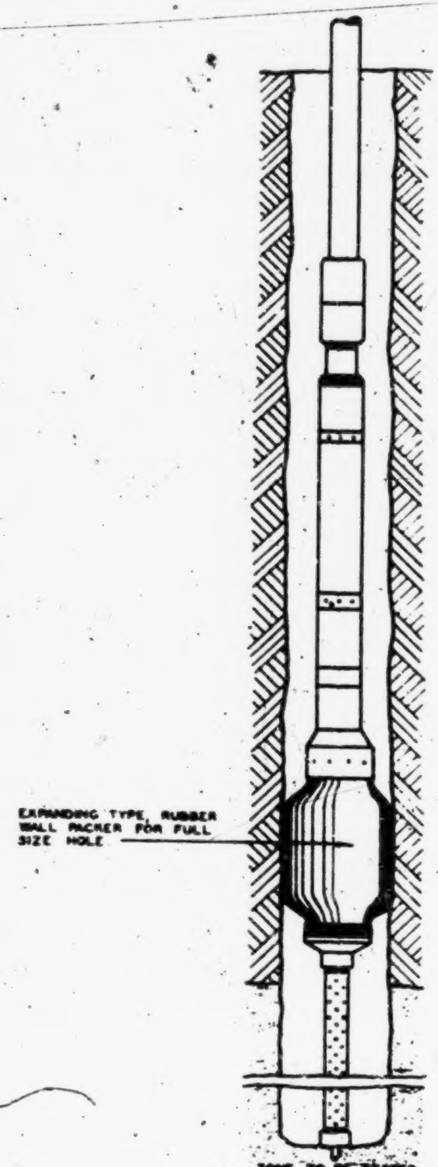
HALLIBURTON OIL WELL CEMENTING CO.

TESTING SERVICE

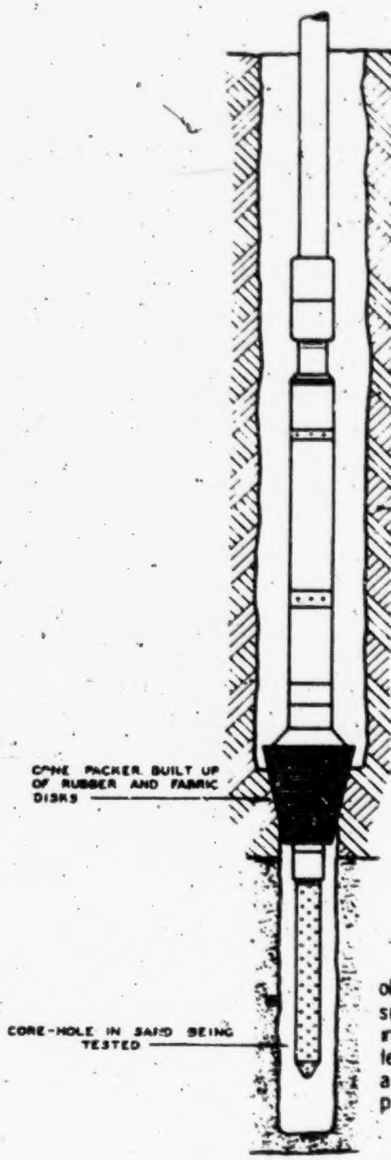
CALIFORNIA FIELDS



CASING TEST
WATER SHUT-OFF.

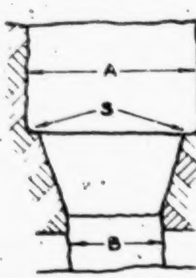


FORMATION TEST
WALL PACKER TYPE.



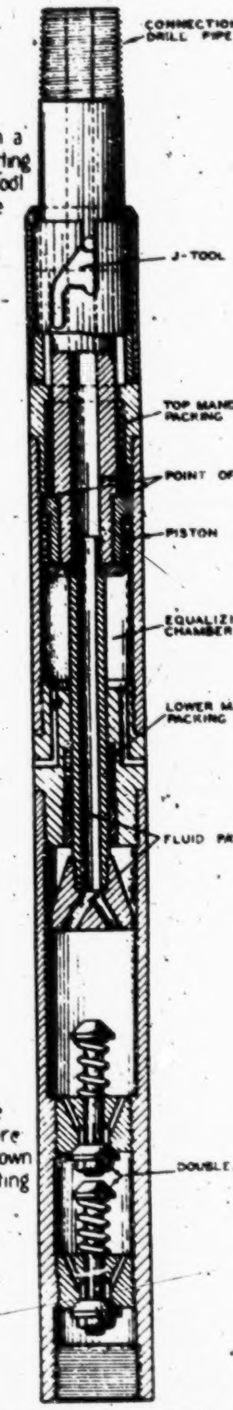
FORMATION TEST
CONE PACKER TYPE.

NOTE: HOWCO J-Type Tester opens with a strain to right and lowering drill pipe after setting packer, no complete rotation or go-devils used. Tool closes when drill pipe is picked up. Controlled rate of valve opening eliminates shock on formation or casing. Full weight of drill pipe on packer is not necessary during test. Circulation can be established whenever necessary without opening tester.



PREFERED TYPE SEAT
CONE PACKER TESTS.

NOTE: Best results on cone packer tests are obtained by making core-hole diameter B as much smaller than main hole, diameter A as is possible in good drilling practice. Run off-set reamer before testing to secure good seat with shoulders as shown at S. Core-hole should be well cleaned by circulating prior to testing.



D. 56 Ex.
Halliburton
Honolulu Oil
Deft
H-1

Cross

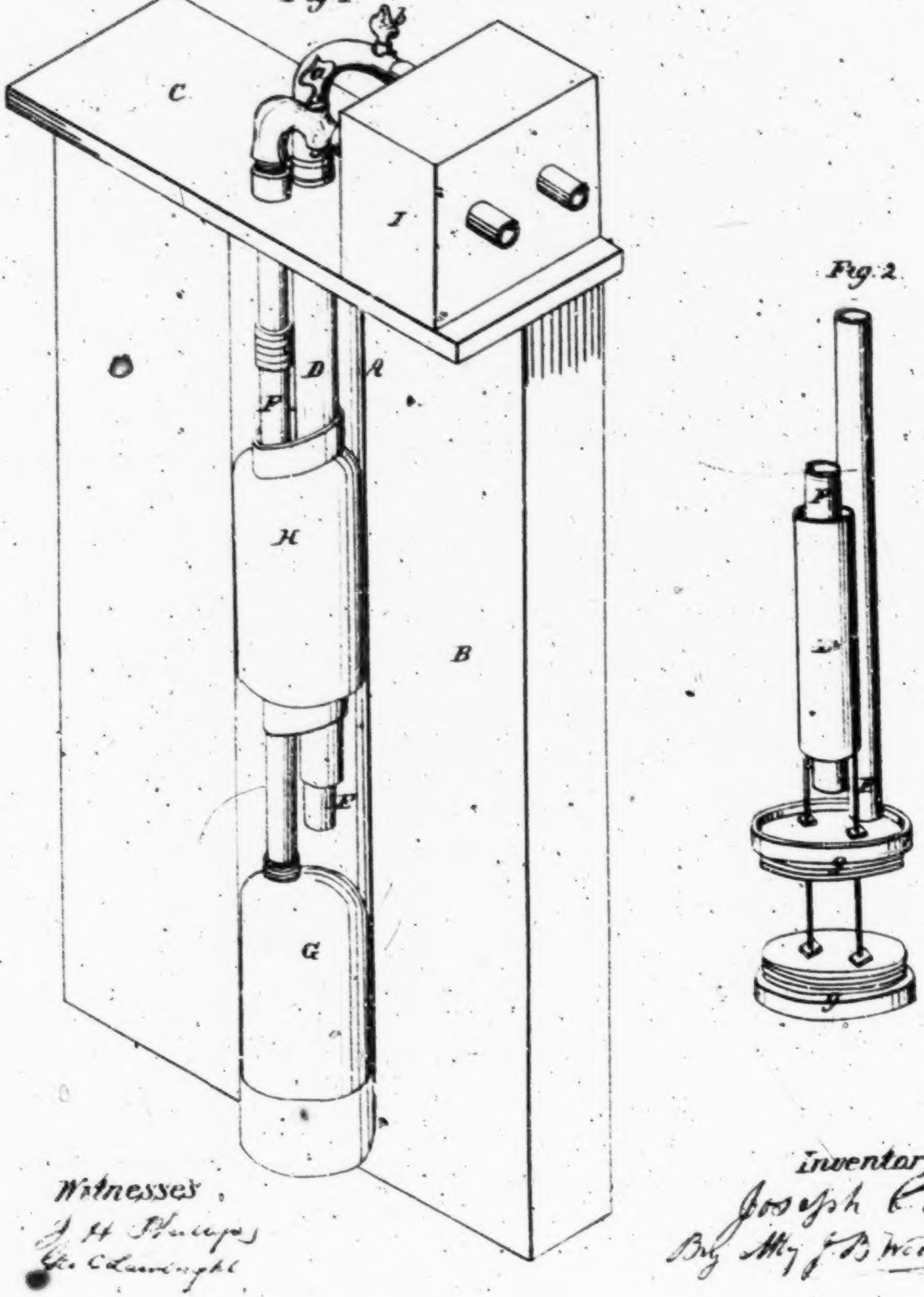
J. C. Lyon,

Testing Oil Wells,

No. 46,124, Patented Jan. 31, 1865.

Fig. 1

Fig. 2



Witnesses

J. H. Phillips

Geo. C. Lamright

Inventor,

Joseph C. Lyons

By Atty J. B. Woodruff

UNITED STATES PATENT OFFICE.

JOSEPH C. LYONS, OF AUBURN, NEW YORK.

IMPROVEMENT IN TESTING OIL-WELLS.

Specification forming part of Letters Patent No. 46,124, dated January 31, 1865.

To all whom it may concern:

Be it known that I, JOSEPH C. LYONS, of Auburn, in the county of Cayuga, in the State of New York, have invented a new and useful Apparatus for Testing Oil-Wells; and the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, making a part of this specification.

Figure 1 represents a perspective view of the apparatus, showing the two flexible air-chambers as inflated in the bore, with the discharge and air pipes. Fig. 2 shows a detached view of a section of the discharge and air pipes, with the frame-work *g g* attached, for forcing the lower air-chamber, G, down into the well.

The object of my invention is to find where water, oil, and gas veins or fissures are, and to effect a cut-off above and below at any desired point or place in the walls of oil-wells, and to enable a change in the position of the cut off to be made at any time and at any depth below the surface, and also to convey the oil or other fluids contained between the flexible air-chambers forming the cut off, to be discharged at the surface.

My invention consists in placing within the walls of oil-wells two flexible air-chambers, the upper air chamber surrounding the air and discharge pipes, the same being so connected with the pipes that they may be forced down by them into the well to any desired point or depth, and there inflated, both at the same time, very speedily, so as to close the communication from above and below, thereby testing the different strata and ascertaining what and where the different fluids find their vent into the shaft of the well, thus enabling the water and gas courses to be effectually shut off from the oil-veins, both from above and below, causing the oil to be discharged from the surface of the wells free from other admixtures.

To enable others skilled in the art to construct and use my apparatus for testing Artesian oil wells, I will describe it and its operation more fully, referring to the drawings, and to the letters of reference marked thereon.

To illustrate the interior of the shaft or hole bored into the earth for the purpose of obtaining pure water and (more recently) oil, called "Artesian wells," I use a glass tube, A, secured in a vertical position to a plank, B, which may be so shaded as to represent the different strata and veins of fluids. In the shaft A, extending down from the top or surface of the ground C, I suspend the discharge pipe or tubing D, through which passes an air-pipe, E, extending a little below the bottom of the discharge-pipe D. The air pipe E may be dispensed with in free-flowing wells, but where the fluid to be raised is of a thick and adhesive quality, by forcing down a strong current of air, creates an ebullition and greatly facilitates bringing the substance to the surface.

On the side of the discharge-pipe D, and secured to it at intervals, I place another smaller tube or air-pipe, F, it extending down some considerable distance below the bottom of the pipes D and E, the pipe F having attached to its lower end a frame or basket, *g g*, somewhat smaller than the caliber of the well, around which frame *g* is secured a bag, G, made of strong flexible material, which, being inflated, by forcing air down the pipe F, fills out and presses hard against the sides of the shaft A, shutting off the communication below entirely while the air chamber G *g* is inflated. A short distance above the lower end of the discharge-pipe D, and entirely surrounding it and the air pipe F, is secured another flexible air-chamber, H, into which the air is forced through an orifice in the side of the tube F, so that it is inflated and fills the wall of the well above at the same time the lower chamber, G *g*, does below. This process of trying and testing the different strata, and separating the fluids which find vent in the shaft of an Artesian or oil well, can be very easily effected by my apparatus, the air pump and receiver I being placed new on one side of the top of the well, the stop-cocks *a* and *b* being connected with the receiver I so that the air tubes E and F can be easily coupled on in sections as the apparatus is being let down, so that tests can be made at every ten or twelve feet the whole length of the shaft after it is bored to any desired depth.

It will readily be seen that by my invention a sure and certain test of all of the fluids can be effected, and the location of every different ingredient accurately ascertained, and that any one of them can be separated from the others and brought to the surface at the will of the operator; and among other advantages

to be derived by inflating air-chambers to be used as cut-offs (in the place of the seed-bags which are in use) is that they can at any time be changed in their position in the shaft of the well, or taken out of one well and used in another, without any damage to the apparatus, which is not the case with the seed-bags.

Having thus described my invention, the mode of applying the same, and its operation and effect, what I claim as new and useful, and desire to secure by Letters Patent, is—

The combination and arrangement of two flexible air-chambers with the air and discharge pipes so that the air-chambers can be placed at any point within the walls of oil-wells, and there be inflated, whereby to cut off above the upper and below the lower chambers water, gas, and other substances, and thereby allow the oil to pass from a fissure between the two chambers and out of the discharge pipe, substantially as herein set forth.

JOSEPH C. LYONS.

Witnesses:

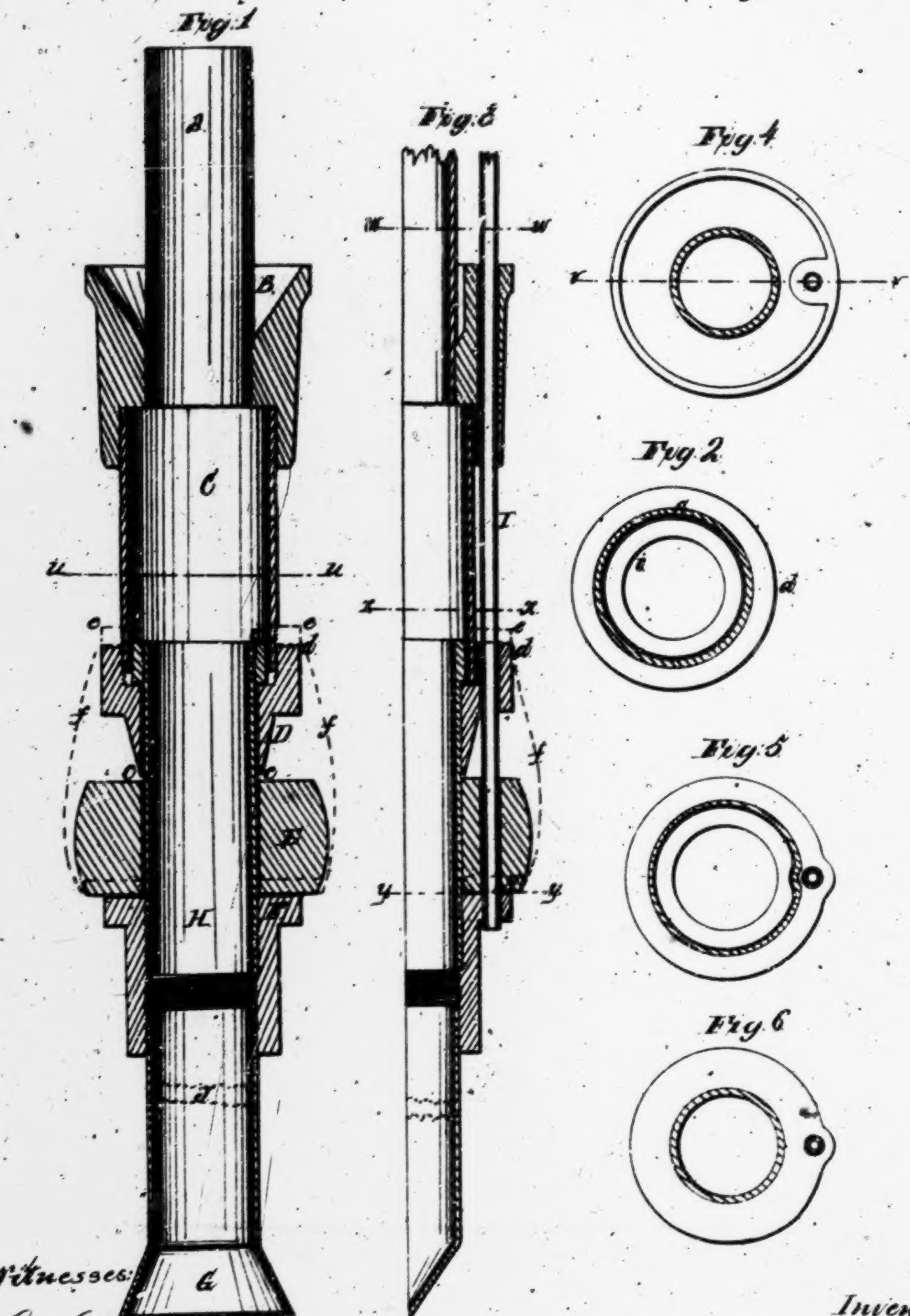
J. S. BROWN,

J. B. WOODRUFF.

O. B. Latham.

Well Packing.

No. 56,234. Patented July 10, 1866.



Witnesses:

Inventor

O. B. Latham

UNITED STATES PATENT OFFICE.

OBADIAH B. LATHAM, OF SENECA FALLS, NEW YORK.

IMPROVEMENT IN OIL-WELL TUBES.

Specification forming part of Letters Patent No. 56,234, dated July 10, 1866.

To all whom it may concern:

Be it known that I, O. B. LATHAM, of Seneca Falls, county of Seneca, and State of New York, have invented a new and useful Shut-Off for Wells; and I do hereby declare that the following is a clear and exact description of the construction and operation of the same, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a vertical section. Fig. 2 is a transverse section through the line *u u*, Fig. 1. Fig. 3 is a vertical section through the line *v v*, Fig. 4. Fig. 4 is a transverse section through line *w w*, Fig. 3. Fig. 5 is a transverse section through line *x x*, Fig. 3; and Fig. 6 is a transverse section through line *y y*, Fig. 3.

In order that persons skilled in the art may be enabled to construct and operate my machine, I will proceed to describe it.

Like letters in different figures refer to like parts.

This invention consists in certain devices, hereinafter fully described, for the purpose of preventing water or other substance from passing below or above any required point in an oil or water well, and also for the purpose of preventing the apparatus from getting fast in the well from an accumulation of débris above it.

A is the main pump-tube, running from the top of the well down to the funnel-shaped socket B, into which it is screwed. The use of the funnel-shaped socket, which is of a diameter at its upper edge equal to that of the well less an eighth of an inch or thereabout, is to check débris in its downward progress. It is screwed upon the hollow cylinder C, which is slightly elliptical in form, for a purpose hereinafter described. Said cylinder is screwed within the flange *d* of the hollow truncated cone D, the lower edge of which is made about an eighth of an inch blunt, so as to form a shoulder for the purpose of preventing the shut-off E from sliding up on the cone while the apparatus is being lowered into the well.

i is a band of a shape corresponding to that of the cylinder C, within which it is fitted to work freely, and is securely fastened to the top of the pump-tube H. Its minor axis is equal to the diameter of the said tube, which ends in a solid chisel, G, resting upon the bottom of the well. The chisel sustains the whole apparatus, prevents any rotation of the tube H, and secures the immobility of the cylinder C by means of the elliptical shape of said cylinder and of the band *i*.

E is the "shut-off," so called, consisting of gutta-percha or other elastic or flexible material, of a diameter a little less than that of the well, so that it may be raised or lowered therein freely. When in use the shut-off is forced tightly against the circumference of the well by the pressure of the hollow truncated cone D, which is driven between the tube H and the shut-off by the weight of the main pump-tube A and of whatever débris may be upheld by the funnel-shaped socket B. As soon as the passage of water past the shut-off is stopped in this way and a vacuum created beneath, the pressure of the superincumbent water is exerted upon the shut-off, together with that of the atmosphere above the shut-off. It will be seen that by this arrangement the power exerted to expand the cut-off is always proportionate to and greater than the resistance to be overcome.

F is a flange screwed upon the tube H for the purpose of sustaining the shut-off under pressure.

Whenever it is desired to change the location of the apparatus, if the mass of débris resting upon the funnel-shaped socket B impedes the operation, it is only necessary to remove the pumping apparatus from within the tubes A and H, unscrew the tube A from the cylinder C, (which is prevented from becoming itself unscrewed during the operation by the immobility secured to it through its elliptical shape from the chisel G,) and raise the tube to a sufficient height to allow the débris to fall into the cylinder C and tube H through the funnel-shaped socket B. The tube A may then be lowered till it strikes the funnel-shaped socket, which cannot fail to guide it to its proper orifice, into which it is to be again screwed. The truncated cone D is then to be lifted up from its position between the tube H and the shut-off E, when the latter will resume its original dimensions. The whole apparatus is then to be raised to the surface, the inclosed débris emptied out, and the apparatus lowered again to any position desired.

The pump-cylinder (not shown in the draw-

ings) is situated between the chisel G and the end of the pump-tube H, and is not subject to change of position. Whenever it is desired to increase or diminish the distance between the shut-off and the chisel, lengths of pipe are to be added to or taken from the tube H. The shut-off can be located and worked to perfection at any depth.

I is a pipe sometimes made use of, running through holes drilled in the funnel-shaped socket B, flange *d*, shut-off E, and flange F, in which latter it is made fast, while the funnel-shaped socket and flange *d* work freely upon it. This pipe is intended as a means of egress for gas confined below the shut-off, or of ingress for air from above the shut-off, forced down by atmospheric or other pressure to promote the flow of oil into the pump-cylinder.

It will be seen from an inspection of Fig. 5 that when the pipe I is used a depression is made in the cylinder C to accommodate said pipe. A corresponding depression being made in the band *i*, the necessity of the cylinder and band being made elliptical is avoided.

e is a flange screwed upon the cylinder C and griping, in conjunction with the flange *d*, the upper edge of a sack, *f*, consisting of leather, bladder, or other suitable material, the lower edge of which is griped between the flanges F and *g*, screwed upon the cylinder H for the purpose. The sack *f* is made water-tight, and when in use is filled with water. It subserves the double purpose of a packing and protection to the shut-off E from the destructive action of oil, as no oil can penetrate to the shut-off from the outside, and whatever leaks into the sack from the inside floats upon the surface of the water above the shut-off. It is only to be used for this purpose when the shut-off is located at an oil-yielding stratum. It is to be used as a packing when it is desired to locate the shut-off in mud or at a point where the walls of the well are considerably irregular. It possesses peculiar advantages for this purpose. Its diameter can be increased suddenly by the pressure before spoken of, which operates it to any extent required, and it forms an immovable packing as long as the pressure continues.

When it is required to change the location of or withdraw the apparatus, it is easily and quickly elongated, and thus gotten out of the way by the upward pull. It is to be used or not, either in combination or not in combination with the shut-off, as occasion may require.

What I claim as new, and desire to secure by Letters Patent, is—

1. The cylinder C and band *i*, varying from a true circle, and arranged, in relation to the cylinder H and an external packing device, substantially as and for the purpose described.
2. The sack *f*, when used in combination with the parts H, F, G, E, D, and *d*, as and for the purpose set forth.
3. The chisel G, when used in combination with the described apparatus, for the purpose set forth.
4. The whole apparatus, arranged as described.

O. B. LATHAM.

Witnesses:
GEO. E. BROWN,
A. MOORE.

No. D 56 Eq

Halliburton [illegible]

vs.

Honolulu Oil

Defts EXHIBIT

No. H-3

Filed .... 19......

R. S. ZIMMERMAN, Clerk

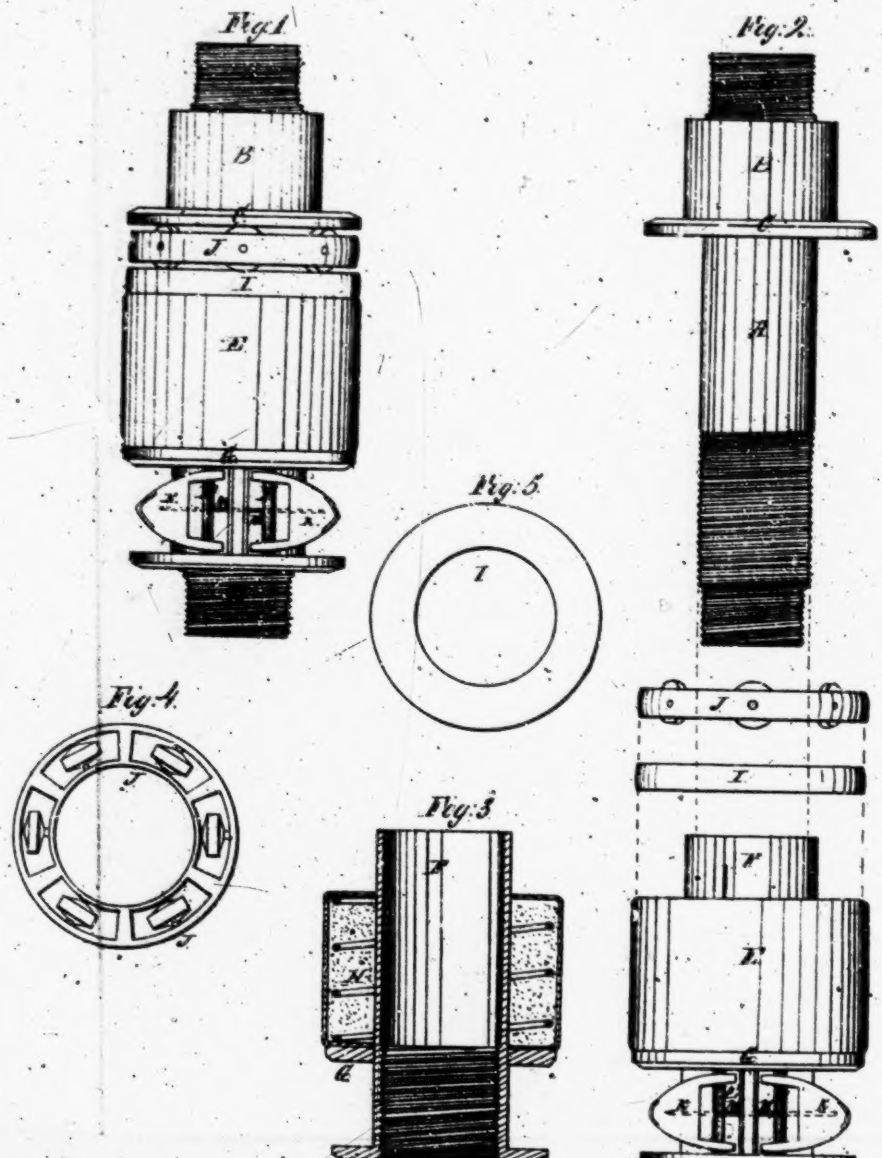
By Cross

Deputy Clerk

H. Kewley,

Pump Packing.

No. 53,837. Patented Oct. 16, 1866.



Witnesses

W. H. Burridge

J. W. McClelland

Inventor

UNITED STATES PATENT OFFICE.

HENRY KEWLEY, OF MADISON, OHIO.

IMPROVEMENT IN STOP-WATERS FOR OIL-WELL TUBING.

Specification forming part of Letters Patent No. 58,837, dated October 16, 1866.

To all whom it may concern:

Be it known that I, H. KEWLEY, of Madison, in the county of Lake and State of Ohio, have invented certain new and useful Improvements in Stop-Waters for Oil-Well Tubing; and I do hereby declare that the following is a full and complete description of the construction and operation of the same, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a side view of the stop-water. Fig. 2 shows the relation of the several parts to each other; Fig. 3, a detached transverse section; Fig. 4, a friction-roller washer; Fig. 5, a plain flat washer.

Like letters refer to like parts in the several views presented.

A, Fig. 2, is a brass tube, to which the collar B and the flange C are attached. On the upper and lower end of the tube is cut the thread D D. It will be remarked that the two extreme ends of the tube are of the same size, but that an inch or so from the lower ends the thread is enlarged in its diameter. The purpose of these screws will hereinafter be described.

E, Figs. 1 and 2, is a strong leather sack or bag, and is fitted to the outside of the sleeve F, Figs. 2 and 3, the lower end resting upon the flange G, which is a little less in diameter than the sack. Within this sack, and coiling around the sleeve F, is the spring H. This spring plays loosely in the sack and around the sleeve.

When the spring is placed in its proper position in the sack, the sack is then filled with sand, the spring being surrounded and buried in it. The plain washer I, Fig. 5, is then slipped on over the end of the sleeve, and lies upon the upper end of the sack. This washer, corresponding relatively to the washer G at the lower end, thereby places the sack between two washers. Immediately upon the plain washer is placed the friction-roller washer J, Fig. 4.

The sack and washers, on being properly arranged, the tube A is then passed into the sleeve, the lower end of the sleeve being provided with a female screw, and the end of the tube, as above described, having two threads cut upon it, one of larger diameter than the other, the largest thread is screwed into the sleeve until the flange C comes down upon the friction-washer J. On screwing the tube into the sleeve by means of the tube-tongs, the sack is compressed so as to cause it to expand outward, the degree of expansion being as the force applied. The friction-washer being placed between the plain washer and the collar C prevents any great degree of friction resulting from the screwing of the two parts together.

A section of well-tubing, on being screwed to the lower end of the tube, which, as above described, is smaller than that screwed into the sleeve, also sections of well-tubing, on being screwed to the upper end of the tube, the water-stop is then lowered into the well, and when at the desired depth the tube is screwed into the sleeve, causing, as above stated, an outward expansion of the sack until it presses against the sides of the well, making thereby a water and gar tight joint, the oil passing up through the lower section of tubing, also through the sleeve to the tubing above, where it is free from water and to be discharged in the ordinary way.

In order to withdraw the stop-water from the well, the tube is unscrewed, releasing thereby the pressure from the ends of the sack. By the force of the spring H, above described, the sack is elongated, which releases its outward pressure against the sides of the well. It then can be lifted out in the ordinary way.

To prevent the stop-water from turning in the well while screwing the tube A into the sleeve, the lower end of the sleeve is provided with a pair of dogs, K K. These dogs are pointed with steel, and are connected to the sleeve by the pins E E, forming a joint. It will be remarked that the points of the dogs project out a little beyond the side of the collar G and the sack, and are retained in this position by the springs M M.

On screwing the tube down into the sleeve, should the sleeve turn, the dog K catches into the wall of the well, and thereby prevents the stop-water from turning in that direction, and so, on reversing the movement of the screw, the dog K catches into the wall and prevents

it from turning in the other direction. The peculiar rounded form given to the outer side of the dogs prevents them from catching in the wall on withdrawing the stop-water from the well.

What I claim as my invention, and wish to secure by Letters Patent, is—

1. The spring H, the sack E, and the tube F and the flange G, in combination with the washers I and J, in the manner and for the purpose set forth.

2. The dogs K K, the springs M M, in combination with the sleeve F, in the manner set forth.

3. The sleeve F, the sack E, and the washers J and I, in combination with the tube A, for the purpose and in the manner substantially described.

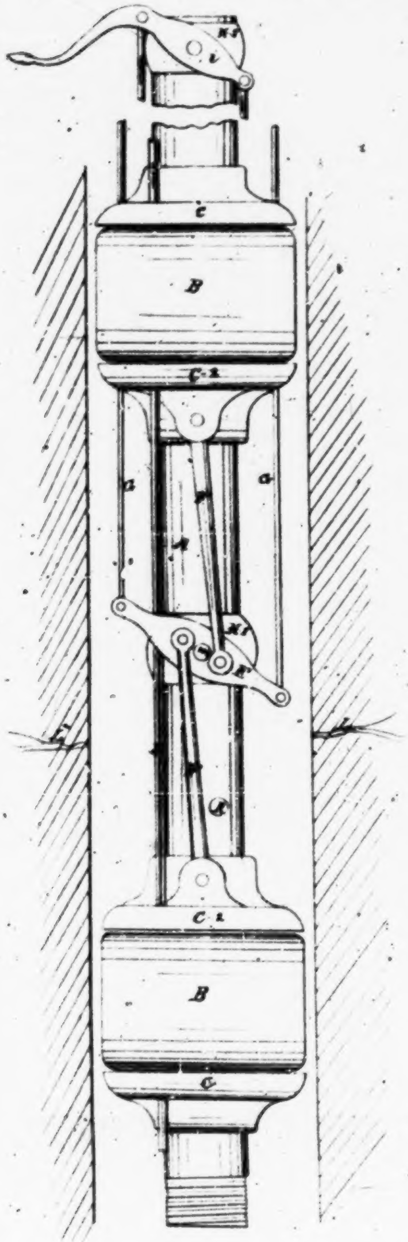
HENRY KEWLEY.

Witnesses:
W. H. BURRIDGE,
A. W. MCCLELLAND.

Burr & Wakelee,

Oil Pump,

No. 68,350. Patented Sep. 3, 1867.



Witnesses

Geo P Burrall

Inventors

Theodore Wakelee

United States Patent Office.

THEODORE BURR AND THEODORE WAKELEE, OF BATTLE CREEK, MICHIGAN.

Letters Patent No. 68,350, dated September 3, 1867.

IMPROVEMENT IN APPARATUS FOR TESTING DEEP WELLS.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that we, Doctor Theodore Burr and Theodore Wakelee, both of the city of Battle Creek, in the county of Calhoun, and State of Michigan, have invented a new and useful Apparatus for Exploring, Testing, and Pumping in Oil and Saline Wells; and we do declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The nature of our invention consists in providing an apparatus that will (in the first place) explore and test the properties of the well at all points from top to bottom, and enable us to ascertain the exact locality of each and every siphon or mineral vein in said well. Secondly, when the exact locality of the desired vein or siphon is found, by the mechanical operation of this invention (hereafter described) we are enabled to shut off everything foreign to the object sought for, both above and below, thereby enabling us to apply the whole force of our suction directly upon the object, whether oil or mineral-water. Third, the nature of this invention is such that it overcomes the difficulties so frequently found in oil and mineral wells, caused by the gas being confined below the seed-bag, which is now used to shut off the water above the vein; thus, by the expansive force of the gas, it overpowers the current of oil and finds its way into the siphon, carrying with it oil, water, and loose particles of earth, damming up the siphon and rendering the well useless, or otherwise it will throw out the pump and cause a trouble in that form. The gas pipe (hereinafter described) removes that difficulty, and makes it harmless.

To enable others skilled in the art to make and use our invention, we will proceed to describe its construction and operation.

We use any of the metallic piping already introduced for pumping oil or mineral-water. This pipe, marked A on the drawings, is fitted at the ends so as to be attached to other joints of piping of similar dimensions; thereby it becomes a component part of the pump. Then two flanges, marked C C, are firmly secured to the pipe A, at any proper distance apart for operating purposes, with the face sides towards the centre, as seen in the drawings. Then two flanges being placed on the pipe A, and marked C–2 C–2, are fitted loose, so as to slide with ease on the pipe A, and facing from the centre, thus forming two pairs of flanges. Then two India-rubber bands, marked B B, are placed on the pipe A, between the flanges of each pair (using soft vulcanized rubber that will yield to the pressure when applied by the means hereafter described.) This forms two packing-bands to be used for the purpose of shutting off the water from above and below the siphon L L. Then a band, marked H 1, is secured firm to the pipe A, equidistant from either packing-band B B. This band H 1 is provided with a pivot, *m*, on its opposite sides, protruding out from the band H 1 sufficient to form a fulcrum and support upon which the brake E operates. The brake E is constructed in an irregular elliptical form, encircling the band H 1, and resting on the pivot *m* at its shortest central diameter. Then four extension-rods, marked F F, (two of which are not shown in the drawings,) have one end connected to the brake H 1 near the fulcrum, by pairs, the upper rods connecting with the upper flange C–2 being placed opposite each other on the flange and brake; (only one is shown on the drawings.) The lower rods F are connected to the lower flange C–2. Each rod is attached to the flanges by means of a pin, the rods F being attached to the brake E opposite the fulcrum, so that by the movement of the brake each pair of rods will move in an opposite direction, thereby causing the flanges C–2 C–2 to press tightly against the rubber bands, or otherwise loosen the pressure. Two rods, marked G G, one attached to the brake at its longest central diameter, pass up through the upper packing and connect to the lever *i* at the top of the pump. This lever encircles a band, H 2, similar to the one described below, except a handle is applied to increase the power necessary to operate the brake below. By bearing down on this handle of lever H 2 we press the rubber out so as to fill the cavity of the well at both upper and lower packing-flange, thus shutting off all above and below the packing. Then, to provide for the suction, an aperture, K, is made in the pipe A between the two packing-flanges, with the bottom end of the pipe A stopped. By this arrangement we concentrate the whole of the suction-power direct upon the siphon L. Then, to avoid the difficulty arising from gas below, we place a gas pipe on the outside of the pump pipe, which is marked D on the drawings, which passes up through both packings, thereby conveying the gas up by the siphon upon which we are operating. In order to loosen the packings we simply raise the lever *i* at the top of the well. Then,

when the siphon is at the bottom of the well one packing operated by one pair of extension-rods, at the same time closing the aperture K in the side of the pipe, and opening at the end of the pipe A.

Having thus described our invention, what we claim, is—

1. The packing-boxes B B, C C, C–2 C–2, constructed and operating substantially as described and for the purpose set forth.

2. The gas pipe D, in connection with the packing-bands, substantially as and for the purpose set forth.

3. The lever *i*, in combination with the connecting-rods G G, brake E, extension-rods F F, and packing bands B B, C C, C–2 C–2, substantially as described and for the purpose set forth.

THEODORE BURR,
THEODORE WAKELEE.

Witnesses:

GEO. P. BURRALL,
JOHN A. VAN VALKENBURGH.

John F. Carll, Sand-Pump for Oil-Wells

73577

PATENTED
JAN 21 1868

Fig. 1.

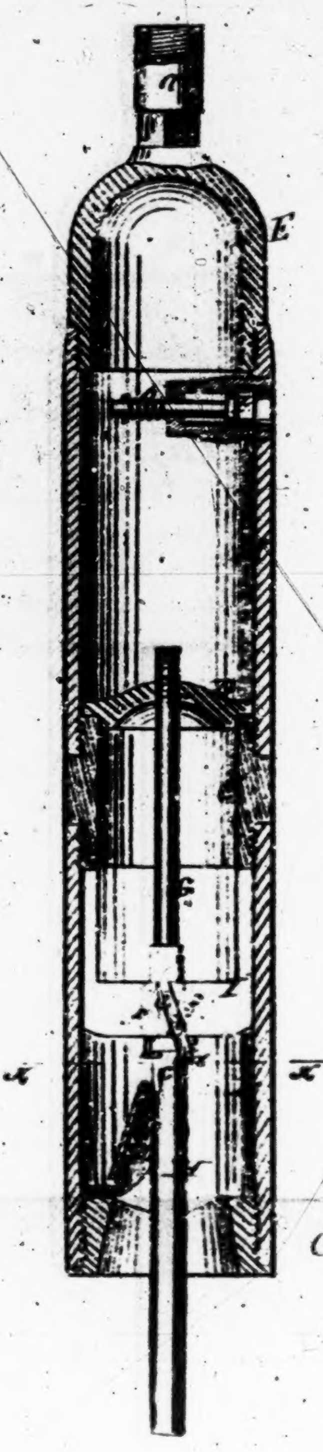


Fig: 2.

Witnesses
Thos Gusche
Wm Trewin

Inventor
Jno F. Carll
Per Munn & Co
Attorneys

United States Patent Office.

JOHN F. CARLL, OF BROOKLYN, NEW YORK.

Letters Patent No. 73,577, dated January 21, 1868.

IMPROVEMENT IN SAND-PUMPS FOR OIL-WELLS.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, JOHN F. CARLL, of Brooklyn, in the county of Kings, and State of New York, have invented a new and improved Sand-Pump for Oil-Wells; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

This invention relates to a new and improved sand-pump for oil-wells, in which the water and debris or sand in said wells is forced into the pump-cylinder through the medium of static pressure, as hereinafter fully shown and described. In the accompanying drawings—

Figure 1 represents a longitudinal central section of my invention.

Figure 2, a horizontal section of the same.

The pump-cylinder is composed of two parts, A B, connected together by a screw-coupling, C, the upper edge of which serves as a seat for a valve, D, which works in the upper part A of the cylinder, similar to a piston or plunger. E represents a cap which is screwed into the upper end of A, is perfectly tight or close at its outer or upper end, and is provided with a socket, *a*, at its apex, having an internal screw to receive a screw which joins it to the auger-stem. The cap and screw, it will be seen, serve as a connection between the pump and the auger-stem. In the upper part A of the pump-cylinder, there is placed a valve, F, opening outward, the valve-stem having a spiral spring, *b*, upon it, which has a tendency to keep the valve closed. This valve is a safety one, and is designed to prevent an undue pressure of air in A. The valve D is screwed or otherwise fitted on the upper end of a stem, G, the latter extending down into a tube, H, which passes through a pendent yoke, I, attached to the screw-coupling C. The tube H has an oblong slot, *c*, made through it, and through this slot and the valve-stem G, a pin, *d*, passes, the latter being allowed to pass through the yoke in consequence of the latter being provided with a slot, *f*, at each side of the hole, through which the tube H passes. These slots *f f* are indicated by the dotted lines in the drawing. The tube H has a pin, *g*, projecting laterally from it, which works in an oblique slot, *e*, in the yoke I. This pin *g* and the oblique slot *e* serve, when the tube H is drawn down, to turn the pin *d* so that it will be, when below the yoke I, out of line with the slots *f f*, and retain the valve D down upon its seat. In the bottom of the lower part B of the pump-cylinder there is placed a flap-valve, J, opening upward. When the pump is let down into the well, the valve D is held down upon its seat C, in consequence of the pin *d*, which passes through the stem G, being out of line with the slots *f f*. The tube H, as the pump is let down, extends below the bottom of the pump-cylinder, keeping the valve J open. The water enters the lower part B of the pump-cylinder, compressing the air therein, the valve D being kept closed by the means previously stated. When the pump nearly arrives at the bottom of the well the tube H comes in contact with the bottom, and the pump-cylinder descending, the valve-stem G is turned in consequence of the oblique slot *e* acting upon the pin *g*, and this turning of the valve-stem brings the pin *d* in line with the slots *f f* in the yoke I, and the valve D is thereby liberated, and is instantly forced upward under static pressure, the air in A above the valve D being compressed, and the water rushing into the lower end of B, carrying the debris with it. The tube H is also drawn within the lower part B of the pump-cylinder, and above valve J, which instantly closes, when H passes above it, owing to the reaction of the compressed air in A, and the pump and its contents are then drawn up. This pumping or cleaning of the well is performed at one operation, and the operation is perfect.

The invention possesses several advantages:

First. It is cheaper. Being used on the drilling-tools, it saves the expense of a sand-pump rope, friction-pulley, &c.

Second. It operates more expeditiously than an ordinary sand-pump, all "churning" being avoided, the pump-cylinder filling instantly when it touches the bottom of the well.

Third. It is safer, being less liable to stick in the hole, and if it should stick, it can be readily loosened on account of having the cable and tools to loosen it with.

Fourth. It is more effectual, for being closed at both ends, it displaces nearly all the sediment at the bottom of the well, and forces it up around the outside of the pump, and when the valve opens, this sediment is instantly

forced down under the bottom of the pump and into the same, owing to the weight of water above, the motion being so quick and the force so great, that the bottom of the well is swept clean in an instant.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent—

1. A sand-pump provided with valves D J, and their connecting agencies, arranged in such a manner that the valves will be operated automatically, and the pump filled with sand or debris under the static pressure of the water within the well or hole, substantially as herein shown and described.

2. The valve-stem G, with the tube H, yoke I, oblique slot *e*, pin *g*, and the slots *f f*, all arranged to operate in connection with the valve J, substantially as and for the purpose specified.

3. The safety-valve F, arranged in relation to the valves D J, applied to the cylinder of a sand-pump, to operate in the manner substantially as and for the purpose set forth.

JOHN F. CARLL.

Witnesses:

J. R. Nesbitt,

A. C. Gardner.

W. H. BIRGE.

SAND-PUMP.

No. 182,098. Patented Sept. 12, 1876.

Fig. 1

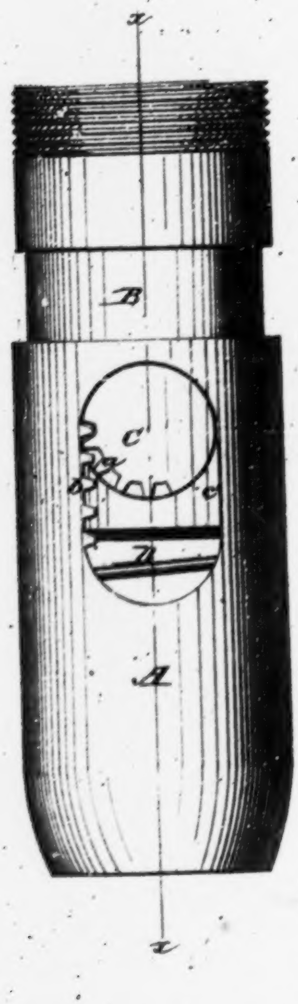


Fig. 2

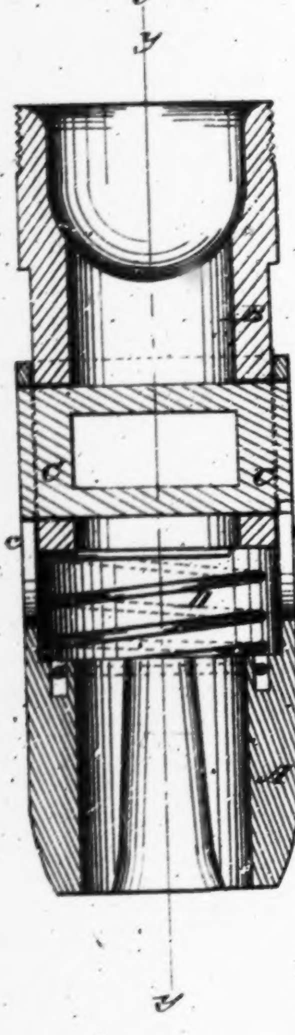
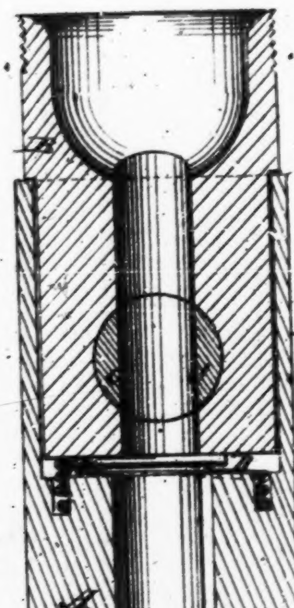


Fig. 3



WITNESSES:

Francis McArdle,

John Goethals

INVENTOR:

W. H. Birge

BY Munn & Co

ATTORNEYS.

UNITED STATES PATENT OFFICE.

WILLIAM H. BIRGE, OF FRANKLIN, PENNSYLVANIA.

IMPROVEMENT IN SAND-PUMPS.

Specification forming part of Letters Patent No. **182,098**, dated September 12, 1876; application filed August 7, 1876.

To all whom it may concern:

Be it known that I, WILLIAM H. BIRGE, of Franklin, in the county of Venango and State of Pennsylvania, have invented a new and Improved Sand-Pump for Oil-Wells, of which the following is a specification:

Figure 1 is a side elevation. Fig. 2 is a vertical section on line *x x* in Fig. 1. Fig. 3 is a vertical section on line *y y* in Fig. 2.

Similar letters of reference indicate corresponding parts.

This invention consists of an inner and outer tube, forming together the lower end of a sand-pump, arranged to slide one within the other, the inner tube being provided with a rotating valve having a segment of teeth on its outer end, which engages with a rack formed on the edge of a slot in the outer tube. A spring assists the parts to regain their normal position.

The object of the invention is to provide a valve which shall have a positive motion, not depending upon the action of the water or sand to open or close it.

A is the external tube that forms the lower end of the sand-pump, and slides easily on the tube B that is attached to the main body of the pump. C is a valve, similar in construction to an ordinary stop-cock plug, which is provided with a bearing or seat in the tube B, and projects a small distance beyond the tube B into slots *c c'* in the tube A. One end of the valve C is provided with teeth at *a* that mesh into the rack *b* formed at the edge of the slot *c'*. D is a spiral spring that rests in a groove in the tube A, and abuts against the lower end of the tube B. The tube forming the body of the sand-pump is closed at the top, excepting a small aperture, which is provided with a valve having a spring arranged to throw it open, but which is capable of closing when under water.

The pump is lowered through the sand and water with the upper and lower valve closed. When it reaches the bottom of the well the part A rests on the mud and sand, and the part B slides down into it, opening the valve, allowing the sand and water to enter the pump. The pressure thus created in the pump opens the valve at the upper end of the pump, allowing the air to escape as the sand and water enter below.

The motion of the valve is positive, and does not depend on the pressure or action of the sand and water to operate it. It is more effective in its operation, and will remove a greater quantity of sand or cuttings at one operation than pumps of ordinary construction.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A rotating sand-pump valve, which is opened and closed by the telescoping or sliding together of the parts forming the lower end of the pump, substantially as specified.

2. The combination of the sliding tubes A and B, valve-plug C, segment *a*, rack *b*, and spring D, substantially as shown and described.

WM. H. BIRGE.

Witnesses:

GEO. ALLEN,
G. W. BIRGHAM.

G. KOCH.

Casing for Oil-Wells.

No. 208,610. Patented Oct. 1, 1878.

Fig. 1.

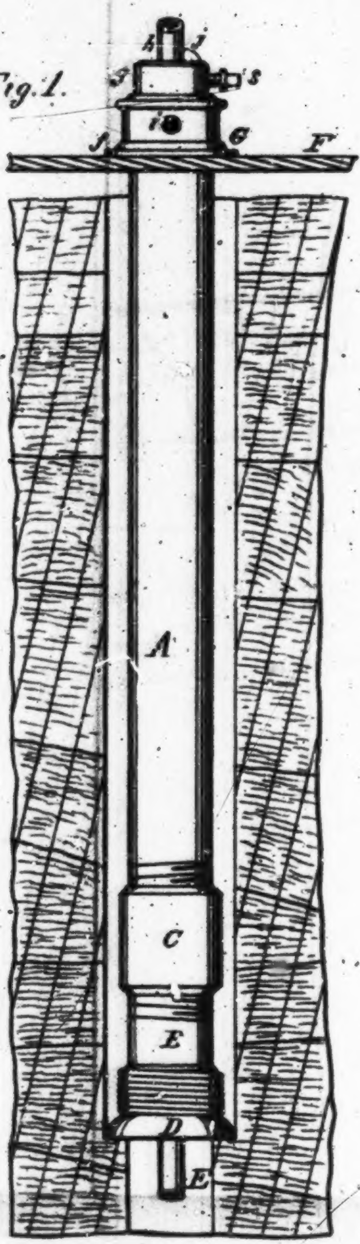
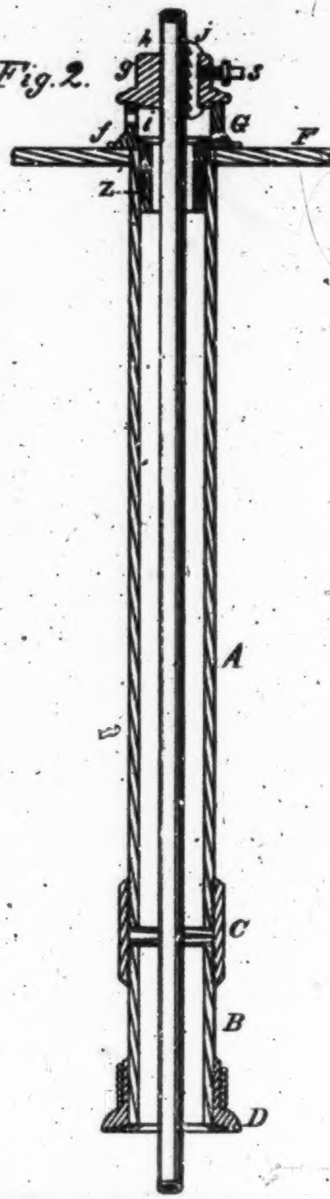


Fig. 2.



WITNESSES

Villette Anderson

INVENTOR

George Koch

UNITED STATES PATENT OFFICE.

GEORGE KOCH, OF ST. PETERSBURG, PENNSYLVANIA.

IMPROVEMENT IN CASINGS FOR OIL-WELLS.

Specification forming part of Letters Patent No. 208,610, dated October 1, 1878; application filed March 31, 1877.

To all whom it may concern:

Be it known that I, GEORGE KOCH, of St. Petersburg, in the county of Clarion and State of Pennsylvania, have invented a new and useful Improvement in Casings for Oil-Wells, which invention will be readily understood from the following description, taken in connection with the accompanying drawing, wherein—

Figure 1 represents a vertical section of an oil-well, showing my improved casing therein; Fig. 2, a vertical transverse section of the casing and all the parts comprising my invention.

The first part of my invention consists in such a construction and combination of a packing with the outside lower end of an oil-well casing-tube that the packing shall not only surround a certain portion of such tube, to which it is firmly affixed, but extend downward beyond its end, so as to rest upon a shoulder or offset found in the rock, and seat itself thereon in advance of the tube, by which a perfectly water-tight joint between the two is easily effected.

It also consists in the construction and novel arrangement of parts, as will be hereinafter shown and described.

In the drawing, representing an oil-well, is placed a tubular casing, A, that may be made in several sections, screwed together, and which united correspond to the depth of casing required, after the manner of those already in use. Attached to and near the bottom of this casing is a short piece of tubing, B, of the same diameter—in fact forming simply a continuation of the main line—which short piece is secured to its immediate upper tube, A, by means of a left-hand screw, that engages with a correspondingly-shaped thread cut on the inside of a union-socket, C, the upper part of which is in like manner provided with a right-hand screw, connecting it with the main tube or casing A. Surrounding the lower part of this short tube is a gum-elastic packing, D, secured thereto by a wrapping of wire or stout cord, which packing is made to extend a short distance below the extreme end of the said tube, so that when lowered in the well it will come in contact with and seat itself on the rock E somewhat in advance of the descending tube, and through its flexibility comply with the inequalities of the rock, and thereby make a perfectly water-tight joint, after which all the water may be pumped out and the operation of drilling into the rock proceeded with without further interference or delay.

For reasons not necessary to specify, the withdrawal of the casing from the well is often required, and as the casings heretofore in use make that very difficult, partly owing to their construction and partly to an accumulation of earthy matter around and above the lower end, the severance of the tube by cutting it off some distance above its lower end is often resorted to as a means of releasing the main portion of the tube, which accomplished the remaining portion is removed after the manner known to oil-well drillers.

By having the lower portion of the casing short, and united to the upper tube by means of a right-and-left-hand screw-socket, as described, the parts, if necessary, may be readily detached, the one from the other, and when the upper portion is removed the short piece B may be easily dislodged from its seat, and brought to the surface by such means as are found in practice most convenient, thus obviating the necessity of cutting or otherwise mutilating the pipe.

The top of the cylindrical casing extends up and just through the derrick-floor F, and is fitted with a circular head, G, that is made to slide some distance into the casing, and is supported thereon by means of an outside overhanging flange, *f*.

Between the casing and its head such packing *z* may be used as will prevent any escape of gas in that direction, and yet allow the head to slide upward, should the pressure be great, and it often becomes great enough to move and lift the entire casing where the head is screwed or otherwise fastened to it.

For conveying the accumulated gas to any desirable distant place, a hole, *i*, is made through the side of the head, from which pipes may be led for that purpose.

On top of the head just described is placed a tightly-fitting cap, *g*, through the center of which is lowered the pump-tube *h*, which tube may be caught, securely held, or released for proper adjustment at any desirable point by

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Having stated the nature of my invention, I claim—

1. In combination with an oil-well casing-tube, A, the gum-elastic packing D, so constructed and applied to the bottom thereof that said gum packing shall not only reach for a distance up and around the tube, but shall extend for a short distance below it, so as to seat itself upon the rock somewhat in advance of the descending tube, and thereby make a perfectly water-tight joint, substantially as and for the purposes set forth.

2. The combination, with an oil-well casing and its lower detachable section, B, having an elastic bearing, D, extending beyond its lower edge, of the right and left threaded union C, connecting the casing and its lower section, substantially as specified.

3. The detachable shouldered casing-cap g, in combination with the binding-gib j and pinch-screw s, substantially as specified.

GEORGE KOCH.

Witnesses:

JOHN LERAH,

ARON KOCH.

(Model.) 2 Sheets—Sheet 1.

J. A. DOWER.

OIL WELL PACKER.

No. 249,228. Patented Nov. 8, 1881.

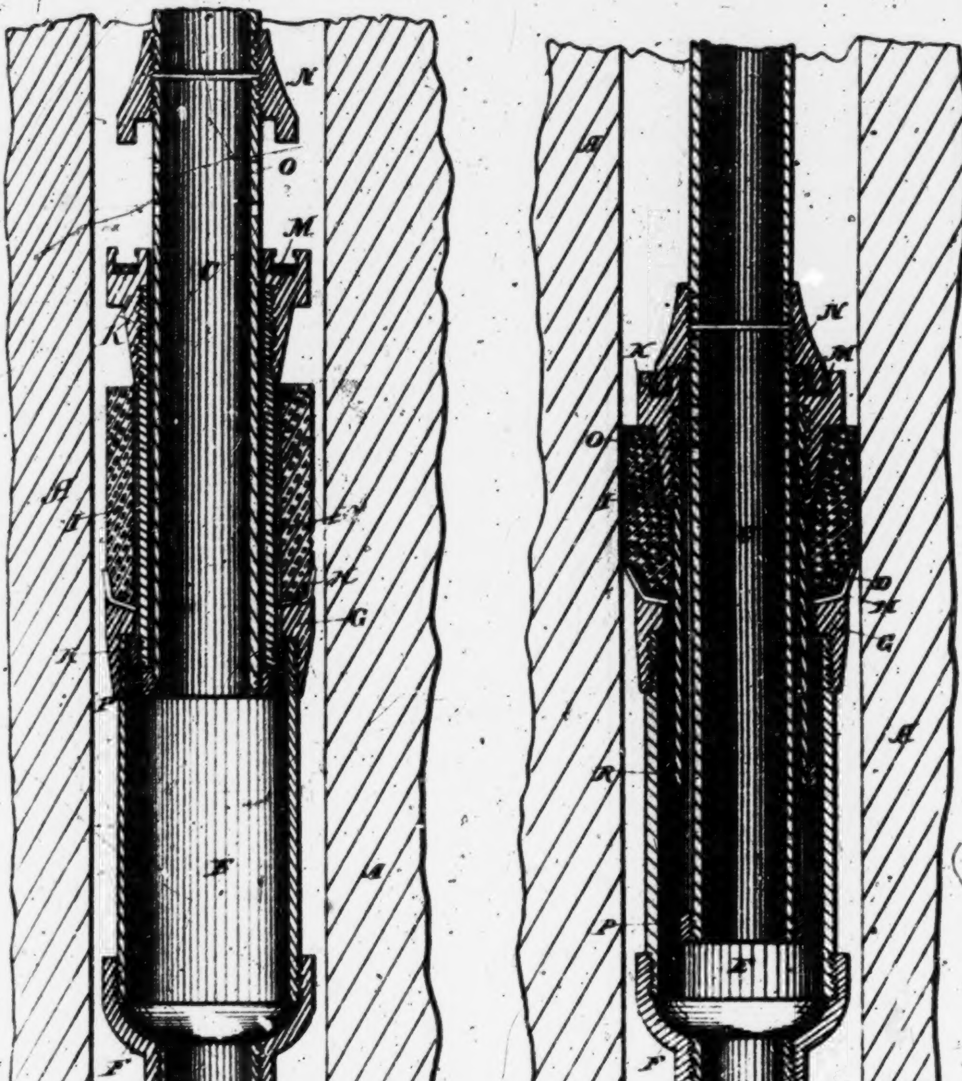


Fig 1 Fig. 2

Witnesses

Carl Wallace

A. B. Howland

Inventor

John A. Dower

By Joseph Smith

Attorney

(Model.)

2 Sheets—Sheet 2

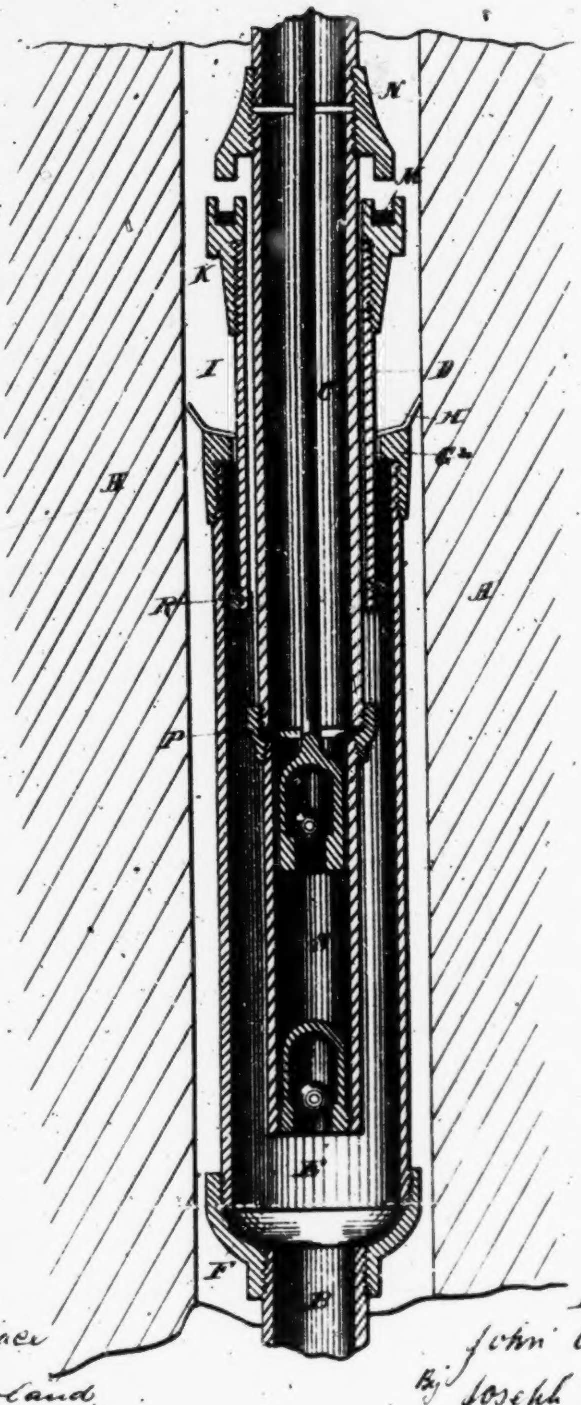
J. A. DOWER.

OIL WELL PACKER.

No. 249,228.

Patented Nov. 8, 1881.

Fig 3



Witnesses
Caleb Wallace
A. B. Howland

Inventor
John A Dower
By Joseph Smith
Attorney

UNITED STATES PATENT OFFICE.

JOHN A. DOWER, OF TITUSVILLE, PENNSYLVANIA.

OIL-WELL PACKER.

SPECIFICATION forming part of Letters Patent No. 249,238, dated November 8, 1881.

Application filed March 25, 1881. (Model.)

To all whom it may concern:

Be it known that I, JOHN A. DOWER, of Titusville, in the county of Crawford and State of Pennsylvania, have invented a new and useful Improvement in Packers for Oil or Artesian Wells, of which the following is a specification.

My invention relates to those packers in oil-wells placed around the tubing at or above the top of the sand or oil-producing rock, the object of the packer being to prevent the free escape of the gas around the outside of the tubing and utilizing it to force the oil up through the tubing, producing what is called "flowing." The tubing has a telescopic joint, and with a collar upon both the upper and lower section, the packing rim or cylinder being placed between the two collars and distended by the weight of the upper section of tubing pressing upon it, the packing-ring being supported by the lower section, which rests on the bottom of the well. As a matter of course, when the packer is in use the water and débris collect in the well above the packer and create a great pressure upon it, which has to be overcome when it is necessary to remove the tubing from the well.

The object of my invention is to enable me to relieve the packer from that pressure by admitting the fluid to the well before the packer is started from its place. This I accomplish in the manner illustrated in the drawings, in which—

Figure 1 is a section of the tubing, telescopic joints, and packer as suspended in the well before reaching the bottom; and Fig. 2 a section of the same when in place and resting on the bottom of the well. Fig. 3, Sheet 2, is a section similar to Fig. 2, but with the addition of a working barrel or pump attached to the upper section of tubing, to illustrate the method by which the well, packed for flowing, may be pumped without removing the packer.

The same letters are used in the different figures to designate the same parts.

A represents the walls of the well; B, the lower section of tubing, which rests on the bottom of the well, and which is perforated to allow the fluid to enter the tubing; C, the upper section of tubing, reaching to the mouth of the well; D, a short section of slightly greater diameter inside than the outside diameter of C, and through which C plays; E, a short and still larger section, into which D plays freely, and which is firmly connected to B by the reducer F. On the upper end of the section E is the collar G, supporting the leather cup H, which incloses the lower portion of and supports the rubber or elastic ring I, which loosely surrounds the section D. On the upper end of the section D is the collar K, which collar is made conical at the lower end, and is also recessed or grooved on its upper side to receive the elastic packing-ring M.

To the section of tubing C is secured the collar N, having its lower edge tongued and fitted to enter the groove on the upper side of the collar K and rest on the packing-ring M.

In Figs. 1 and 2 are the holes or perforations O in the tubing C, just below the collar N.

To the lower end of the sections C and D are secured the collars P and R, which respectively engage with the lower end of the section D and the collar G. This admits of the suspension of the whole contrivance from the section C of the tubing.

The operation is as follows: As the apparatus is adjusted and lowered into the well it is extended, as shown in Fig. 1. When the lower end of the section B reaches the bottom, the section C following down, the tongue on the lower side of the collar N enters the groove on the upper side of the collar K and rests on the packing-ring M, thus forming a tight joint between the sections C and D. Still pressed downward by the weight of the tubing, it forces the section D downward, forcing the cone on the lower side of the collar K inside the packing-ring I, compressing the packing, and expanding it and the leather cup H against the walls of the well, and effectually cutting off any passage of fluid up or down. When it is required to draw the tubing the section C is first raised, disengaging the collar N from the collar K, and admitting the fluid from the outside of the tubing to pass down between C and D, and also through the perforations O into the tubing, thus filling the well below the packing-ring I and relieving it from the pressure, when the whole can easily be drawn from the well.

Some wells need to be pumped occasionally, and to do this it is necessary to provide some escape for the gas, as well as to admit atmospheric pressure to the fluid. Ordinarily it has been considered necessary to remove the packer to accomplish this. I accomplish it in the man-

ner illustrated in Fig. 3, Sheet 2, which shows the same contrivance, except that a working-barrel, S, is attached to the bottom end of the section C of the tubing, and the section E is made sufficiently long to receive it. The openings O in the section C are also omitted. When arranged for pumping the tubing C is raised, disengaging the collars K and N, when the gas escapes freely between the sections C and D, and the well pumps in the ordinary manner.

As a further advantage to be gained by my construction, the vertical play of the section C inside the section D, being entirely free from contact with the elastic packing-ring I, admits of jarring, if it is necessary to do so, in releasing and removing the packer.

I make no claim for the section D telescoping with the section E, nor for the collar G, leather cup H, rubber packing-ring I, nor the cone on the lower part of the collar K, as all these have been previously patented or used.

I claim as my invention—

1. In the tubing of an Artesian well, the section D, telescoping with the section E, the section D having surrounding it the elastic packing-ring I, and with the collar K, in combination with the section C, telescoping with the section D, the collar N on the section C engaging with the collar K on the section D, the joint being packed by the elastic packing M, and with the openings O in the section C, substantially as described, and for the purposes herein set forth.

2. In the tubing of an Artesian well, the section C, telescoping with the section D, the section C having a collar, N, engaging with a collar, K, on the section D, the joint between the two collars being packed or rendered fluid-tight, in combination with any packer connected with or surrounding the section D, substantially as described, and for the purposes herein set forth.

3. As a device by which Artesian or oil wells packed for flowing can be pumped without removing the packer, the upper section, C, telescoping with the section D, which has the packing-ring surrounding it, an annular space being left between the two sections, and with the collar N upon the section C engaging with the collar K upon the section D, so that by slightly raising the section C a free passage is made for gas or fluid inside the packing-ring, substantially as described, and for the purposes herein set forth.

JOHN A. DOWER.

In presence of—

SAMUEL GRUMBINE,

A. S. RALSTON.

(No Model.)

B. FRANKLIN.

DEVICE FOR CONTROLLING AND REGULATING THE FLOW OF OIL WELLS.

No. 263,330. Patented Aug. 29, 1882.

Fig 3.

Fig 4.

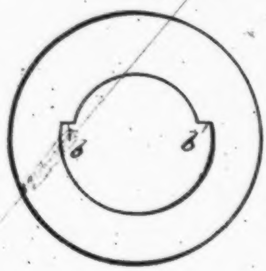


Fig 5.

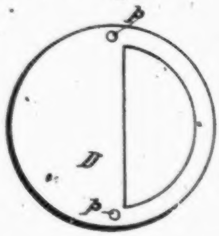


Fig 1.

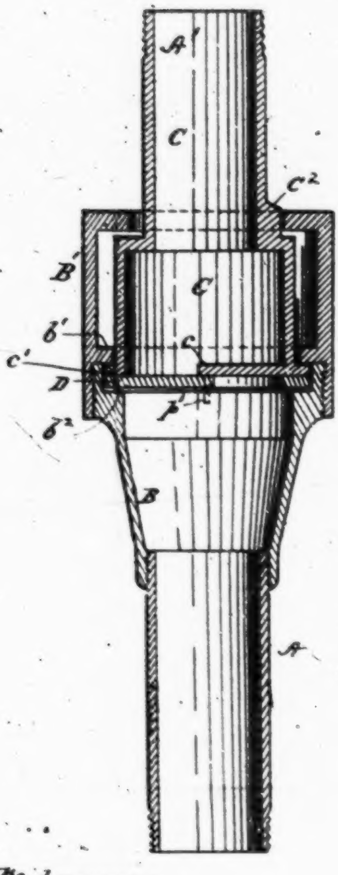
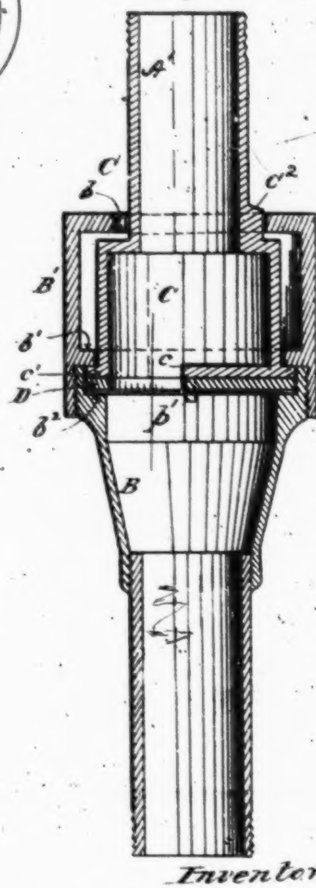


Fig 2.



Witnesses

Inventor

Benjamin Franklin

UNITED STATES PATENT OFFICE.

BENJAMIN FRANKLIN, OF BRADFORD, PENNSYLVANIA.

DEVICE FOR CONTROLLING AND REGULATING THE FLOW OF OIL-WELLS.

SPECIFICATION forming part of Letters Patent No. 263,330, dated August 29, 1882.

Application filed May 13, 1882. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN FRANKLIN, a citizen of the United States, and a resident of Bradford, county of McKean, and State of Pennsylvania, have invented new and useful Improvements in Devices for Controlling and Regulating the Flow of Oil-Wells; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings and the letters or figures of reference marked thereon.

My invention relates to devices for regulating or controlling the flow of oil-wells; and it consists in providing a device which can be connected with the tubing of the well, either within or without the well, but preferably within at a point above the packer, which has within it a damper or valve, which can be opened or closed by turning the tubing part way around.

My device is intended to perform the offices of two different classes of devices now in use for controlling and regulating the flow of wells, as follows: When the tubing is being put into the well or withdrawn from it, it is desirable that no flow take place through it. This is effected, so far as the placing in of the tubing, by a brittle disk, which is placed in the tubing at one of the lower joints, and which closes the tubing until it is broken, which is done after the tubing is in the well by dropping down upon it a sufficient weight to break it; but this is of no service in keeping the tubing closed while drawing it, and, indeed, there is no device to my knowledge, except my own, which will close the tubing while it is being drawn. The other class of devices to which I have above referred is those for temporarily closing the tubing for the purpose of allowing the gas to obtain a head, and then opening and allowing the well to flow copiously for a short time, so as to clear it of paraffine, and also to make a well with short pressure of gas obtain sufficient head to flow. These devices are often made so as to operate automatically, and are placed down in the well, but often the result is obtained by a simple stop-cock operated manually and placed on the flow-pipe at the top of the well.

My device has to be operated manually, but it may be placed deep in the well, and thereby obtain considerable advantage. All the automatic machines for this purpose with which I am acquainted depend upon the tension of a spring or the gravity of a weight to regulate the time of their opening by the confined gas. This necessarily makes them at times defective, for the spring may fail or break, and the whole tubing must be drawn, or it may confine the gas too long by being too heavily weighted. It is impossible to gage the operation of these devices so as to be just right for all the varying circumstances and conditions incident to a flowing oil-well.

My device is free from all complications, being perfectly simple in its construction and operation.

The accompanying drawings illustrate my invention as follows:

Figure 1 is a vertical section, showing the valve closed. Fig. 2 is a like view, showing it open. Fig. 3 is a plan view of the bottom of the part C of my device. Fig. 4 is a plan view of the top of the part B'. Fig. 5 is a plan of the contained disk D.

The construction is as follows: A represents a part of the well-tubing, and A' the point at which the upper section of well-tubing is attached.

B is a flared casting, somewhat like a reducer, which screws onto the lower section of tubing. The top of this part is rabbeted out, so as to form a shoulder, b^2. It is also provided with a screw-thread on the outside.

D is a disk with a half-circle opening in it. (See Fig. 5.) This disk lies on the shoulder b^2 of the part B. The part C, which is attached to the upper section of tubing, is also in the form somewhat of a reducer. Its lower end is half closed by a half-disk, c, and it is provided with a flange, c', at its lower end, and above its offset it has a lug, c^2. The lower end of the part C seats in the rabbet of the part B over the disk D. There are in the disk D pin-holes p p, which fit over pins p', set in the shoulder b^2, and thus the disk D is prevented from turning around, but is allowed to move vertically.

B' is a box-cup, which screws onto the part B. It is provided with an opening for the part C and the lug c^2; but this opening is of such a form (see Fig. 4) that the lug will abut upon shoulders b b when the pipe is rotated, and will therefore prevent more than a half-rotation of

the pipe. The box B′ is also provided with an internal flange, b', which ledges in over the flange of the part C and holds it in the rabbet of the part B.

In Fig. 1 the parts are in such a position that the opening in the disk D is closed by the half-cover on the part C, and hence there is no opening through the device. A half-turn of the tubing from the top of the well will bring the parts into the position shown in Fig. 2, where the two half-openings are upon each other, thus leaving a free escape for the oil.

Between the shoulder b^2 and the flange b' there is enough room to leave a very little play vertically to the parts lying between. When the tubing is in the well the upper section is often held in suspension slightly, just to keep it taut. This relieves the disk D of the weight of the tubing, and when the device is closed the pressure of gas keeps it seated on the part C above it, so there will be no leak, and the tubing can be easily turned the half-turn necessary to open or close the valve.

It will be seen that my device can be operated from the top of the well by turning the tubing, as stated above; that the oil can be shut off by it or allowed to flow at will; that the device can be kept closed while the tubing is being put into the well and then opened, and can be again closed when the tubing is to be drawn.

The disk D may be attached solid to the part B, but it is better to be loose, as shown; but whether seated loosely and held by pins or lugs, or forming an actual part of the part B, it is in fact a part of the lower half of the valve.

What I claim as new is—

1. The combination, with the eduction-tube of an oil-well, of a valve consisting of two parts adapted to abut together and turn upon each other, and provided each with an opening on one side of its center, whereby as the said parts are turned upon each other the said openings may be brought in juxtaposition or not, as desired, and thus open or close the passage in said tubing, substantially as set forth.

2. The combination, with the eduction-tube of an oil-well, of a valve consisting of the parts B, B′, C, and D, constructed and arranged together substantially as and for the purposes set forth.

3. In a shut-off valve for use on oil-well tubing, the combination, substantially as shown, of the following elements: the part B, with shoulder b^2, the disk D, with opening on one side thereof, seated on said shoulder b^2 and retained from turning by lugs or pins p', the part C, with bottom having an opening on one side seated upon said disk D, the part B′, having opening to receive the part C, with stops b b therein to abut upon the lug c^2 on said part C, and also having a flange, b', and adapted to screw upon the part B and hold the part C and disk D upon the shoulder b^2.

In testimony that I claim the foregoing I have hereunto set my hand this 27th day of March, 1882.

BENJAMIN FRANKLIN.

Witnesses:
GEO. A. STURGEON,
H. F. BARBOUR.

(No Model.)

W. McGREGOR.

SECURING MATERIALS AND OBJECTS FROM SUBAQUEOUS BOTTOMS.

No. 582,828. Patented May 18, 1897.

Fig. 1

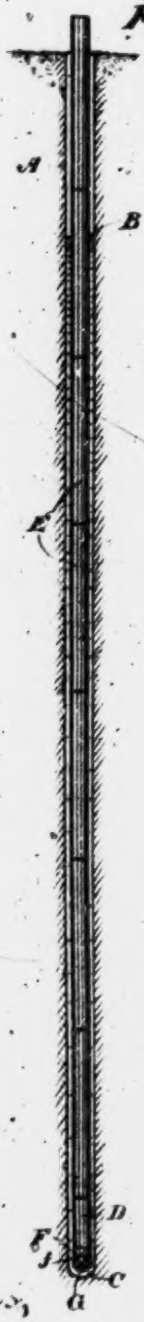
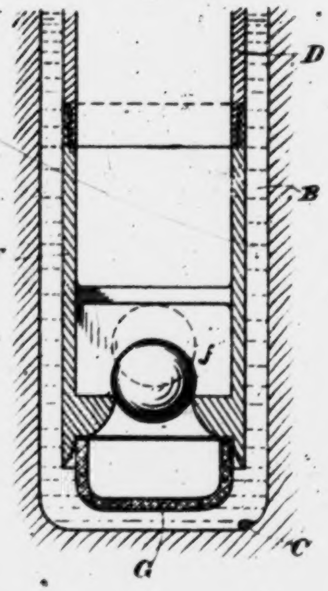


Fig. 2.



Witnesses,
J. H. Nourse
H. F. Ascheck

Inventor
William McGregor
By Dewey & Co.
attys

UNITED STATES PATENT OFFICE.

WILLIAM McGREGOR, OF NANAIMO, CANADA.

SECURING MATERIALS AND OBJECTS FROM SUBAQUEOUS BOTTOMS.

SPECIFICATION forming part of Letters Patent No. 582,828, dated May 18, 1897.

Application filed October 29, 1896. Serial No. 610,457. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM McGREGOR, a citizen of Canada, residing at Nanaimo, British Columbia, Canada, have invented an Improvement in Securing Materials and Objects from Subaqueous Bottoms; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to means for securing materials and objects from bottoms under water.

It consists of a vessel adapted to be lowered into the water, a valve in said vessel, and a frangible cap or cover forming a closure for the lower end of the vessel and temporarily excluding the water therefrom and when broken permitting the water under its hydrostatic head to rush into the vessel and carry the materials and objects from the bottom with it into the vessel.

The object of my invention, broadly stated, is to secure materials and substances lying at a depth. These materials or substances may be samples of a subaqueous bottom, as in "sounding" or in prospecting for precious metals or stones or other natural objects, or they may be foreign to the locality and dropped or lost therein accidentally, in which case their recovery may be of great importance; but in order to better give an understanding of my invention I will state that its special object is to recover from the bottoms of prospecting holes or borings in mining operations such foreign objects as diamonds dropped from the crown-heads of diamond drills, or metallic pieces or objects broken from the boring-tools, or nails, or spikes, or other objects dropped into the hole or into an abandoned hole to which attention is again directed, or any other objects or substances which, as in the case of lost diamonds, are worth recovering, or which in any case would impede progress or injure the tools or apparatus. The removal of such objects is highly important, in that in addition to the direct loss, as in the case of a dropped diamond, their continued presence in the hole often means an abandonment of a bore which has cost a great deal of money.

In the present case I have deemed it sufficient to illustrate my invention in detail in connection with mining prospecting holes or bores from the bottoms of which foreign objects have to be removed or recovered, though it is to be understood that I do not confine my invention to this use, for, as I shall hereinafter explain, it may be used to obtain samples of any subaqueous bottom.

Referring to the accompanying drawings, Figure 1 is a vertical section of a bore or hole, showing the parts therein. Fig. 2 is the section of the lifter F.

A represents a hole or bore. In boring this hole a diamond-drill crown may be supposed to be in use. It is carried on the lower end of a core-barrel, which is itself carried on a continuous series of connected pipes called "rods." These are turned or rotated by suitable mechanism at the surface, and as the diamond-crown cuts the material the latter is forced up into the core-barrel and then the whole apparatus is drawn up and the core-barrel relieved of its contents. The apparatus is once more introduced and the operation repeated. During the operation water is pumped down through the rods to keep the parts cool, and in cases where there is a tendency to cave the water keeps the bore intact. Thus the hole or bore A has water in it, which in the drawings I have designated by B. Now let it be supposed that during the operation one of the diamonds has become loose and has dropped from the crown into the bottom of the hole. I have here designated it by C. This must be recovered. Accordingly the apparatus is lifted out of the hole and the diamond-crown is removed. In its place there is fitted to the core-barrel D, which is carried by the rods E, what may be termed a "lifter." It consists of a short cylinder F, having within it an upwardly-opening valve *f*. Then the rods, the core-barrel, and the lifter are dropped down into the hole.

In carrying out my invention I rely upon the pressure or hydrostatic head of the column of water B in the hole, and in order to make use of this I must keep the water out of the lifter, the barrel, and the rods until ready to admit it, so that its rush will carry the lost diamond up into the lifter and past the valve. It will be seen that I fit to the lower end of the lifter F a bottom G. This is water-tight

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and must be made of some breakable or frangible material. Glass will be found to answer the purpose. This breakable bottom may be fitted to the lifter in any suitable manner. Now as the parts are lowered into the hole the water cannot enter the lifter nor its connected barrel and rods, and therefore the level of the water in the hole rises by displacement due to the entering tools until the water-column stands at a considerable height. When the lifter nearly reaches the bottom of the hole, the parts are dropped with sufficient suddenness to cause the bottom G of the lifter to break against the bottom of the hole. Thereupon the water B rushes in through the broken bottom G, and in its rush it carries the diamond C into the lifter and up past the valve *f* therein by which it is retained. Then the parts are lifted and the diamond is recovered. The valve *f* may be of any suitable character, such as a hinged valve or, as I have shown, a ball-valve, which is best adapted for recovering stones, while a hinged valve is for use where a piece of the core may have been left in the hole, allowing it to freely pass up into the core-barrel.

It will be seen from the foregoing that any foreign objects in the hole may thus be removed or recovered. In the case of a large object—such, for example, as the core-barrel itself—all that is necessary is to cut it up into small fragments and then remove the fragments with my apparatus.

Other cases to which this invention may be applied suggest themselves—such, for example, as prospecting gravel deposits or beds of rivers for precious metals or deep-sea dredging and sounding, in all of which uses the provision for the inrush of water at the proper time under its hydrostatic head could be provided for by simple means, such as that heretofore suggested, or others of like nature.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

An apparatus for securing materials and objects from bottoms under water, consisting of a vessel adapted to be lowered into the water, a valve in said vessel, and a frangible cap or cover forming a closure for the lower end of the vessel and temporarily excluding the water from said vessel and, when broken, permitting the water under its hydrostatic head to rush into the vessel, and carry the materials and objects from the bottom with it into the vessel.

In witness whereof I have hereunto set my hand.

WILLIAM McGREGOR.

Witnesses:

JAMES McGREGOR,

F. G. GEDDES.

No. 785,933. PATENTED MAR. 28, 1905.

O. M. BLOOM.

CASING PACKER SHOE.

APPLICATION FILED JAN. 16, 1905.

Fig. 1.

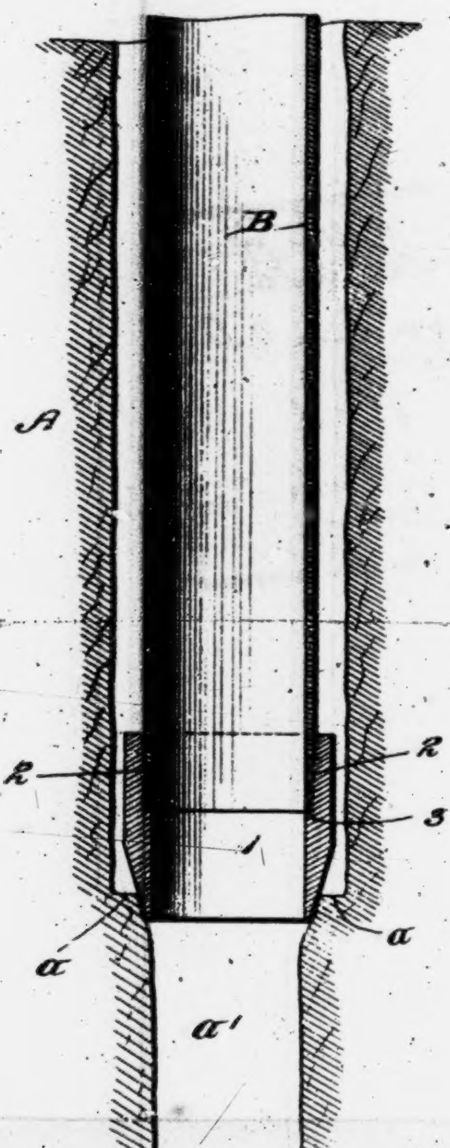
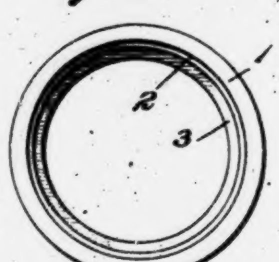


Fig. 2.

Fig. 3.



WITNESSES:

INVENTOR

No. 785,933. Patented March 28, 1905.

UNITED STATES PATENT OFFICE.

ORVIS M. BLOOM, OF INDEPENDENCE, KANSAS, ASSIGNOR OF ONE-HALF TO INDEPENDENCE IRON WORKS COMPANY, OF LIMA, OHIO, A CORPORATION OF OHIO.

CASING PACKER-SHOE.

SPECIFICATION forming part of Letters Patent No. 785,933, dated March 28, 1905.

Application filed January 16, 1905. Serial No. 241,282.

To all whom it may concern:

Be it known that I, ORVIS M. BLOOM, a citizen of the United States, residing at Independence, county of Montgomery, State of Kansas, have invented certain new and useful Improvements in Casing Packer-Shoes; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, wherein—

Figure 1 is a vertical central section of a section of casing, a packer-shoe embodying my invention applied thereto, and a well showing the method whereby the packing of the casing is effected. Fig. 2 is a detached sectional view of a packer-shoe embodying my invention, and Fig. 3 is a plan view of the packer-shoe shown in Fig. 2.

Like symbols refer to like parts wherever they occur.

My invention relates to that class of devices termed "packers," which are employed generally in oil or Artesian wells for the purpose of packing the tube or casing in order to shut off the water from the lower or oil-bearing section of the well.

Ordinarily in the drilling of oil or Artesian wells one or more water-veins are commonly encountered before the oil-bearing sand or the desired depth of the well is reached, and it is essential, especially in oil-wells, that the water from said veins should be shut off from the lower or oil-bearing section of the well. To effect this, the common practice is to first drill a large hole—say, one of eight and one-quarter inches, more or less, in diameter—to a point below the water-veins and to shut off the water therein by inserting a suitable casing and packing therefor, the latter located in said large hole at a point below the water-veins. Thereafter the well is continued downward at a less diameter—say, six and one-quarter inches, more or less—to the oil-bearing sand or until the desired depth has been reached. Where the diameter of the well is reduced, a shoulder is formed, which affords the usual support for the well-casing, and in some instances has been utilized to effect a packing of the casing either by the direct contact of the lower end of the casing or a shoe thereon and in some instances by the interposition between the lower end of the casing or a shoe thereon and said shoulder of an expansible or resilient and compressible packing medium—as, for instance, lead or rubber. Experience has shown that this shoulder at the point where the bore of the well is decreased is seldom perfectly flat, and as a consequence packings dependent thereon are frequently inefficient, so that as a rule expansible packings of rubber or other suitable material interposed between the casing and side walls of the well and dependent for their operation not only on the superposed weight of the casing, but on mechanical expanding devices, are most commonly employed.

The object of my invention is to avoid complex mechanical packings, such as are required for packing with the side walls, and composite packings necessary to insure an efficient packing between the shoulder and the lower end of the casing; and to this end the main feature of my invention, generally stated, resides in a packing-shoe adapted to engage with the lesser bore of the well at the mouth thereof, while a minor or secondary feature of my invention, which relates to the particular means for carrying out my invention, resides in a casing packer-shoe having the form of the frustum of a cone, the lesser diameter of which substantially corresponds to the lesser diameter of the well.

It is well known to those skilled in the art of drilling wells that the bore of the well where the diameter thereof is reduced, or, in other words, the edges of the shoulder, are more or less rounded, seldom regular or square, and liable to crumble under weight, and it is of this fact that I take advantage in applying my improved casing-packer.

I will now proceed to describe my invention more fully, so that others skilled in the art may apply the same.

In the drawings, A indicates a portion of the upper section or casing-section of a well,

a the usual shoulder therein located below the water-veins or water strata, and a' a portion of the lower section of the well or that section of reduced diameter extending downwardly to the oil-bearing sand or its equivalent.

B indicates the usual casing of any desired or required diameter, to the lower end of which is secured a packer-shoe 1, embodying my invention, the greatest diameter of said shoe being preferably from one-fourth to one-half an inch less than that of the well at the point where the packer is applied, and its least diameter being substantially that of the diameter of the lower section of the well, the upper end or mouth of which it is to enter or engage at the shoulder a of the well.

The form of the packer-shoe preferred by me is that of a frustum of a hollow cone recessed and threaded above, as at 2, for attachment to the casing and to form a shoulder 3 to receive the lower end of said casing and relieve the threads from the strain which might tend to strip them from the shoe and casing; but in lieu of such a connection other suitable connection between the casing and shoe may be employed, or, in fact, the shoe can be integral with the lower section of the casing without departing from the spirit of my invention, which contemplates the use of the top of the smaller hole in packing the casing in lieu of the side walls or shoulder of the well, as heretofore practiced.

The packer-shoe on the lower end of a string of casing being lowered into the well and caused to engage the bore of the lower section or lesser diameter of the well, as indicated in Fig. 1 of the drawings, will so embed itself under the weight of a string of casing as to insure an efficient packing, and the sediment, &c., which settles upon the shoulder a of the well and around the packer-shoe 1 will make an absolutely water-tight joint.

It is evident that the packing hereinbefore described will be equally efficient in oil or salt wells and may be applied thereto, and its use under such and similar conditions falls within the scope of the following claims.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination with a well-casing, of a packer-shoe adapted to engage and pack with the lesser diameter bore of an oil or Artesian well, substantially as and for the purposes specified.

2. A packer-shoe for well-casing, said shoe of tapering form and having one diameter corresponding to the lesser diameter of a well with the bore of which said packer-shoe is adapted to engage, substantially as and for the purposes specified.

3. A packer-shoe for well casing or tubing, said shoe having the form of a frustum of a hollow cone the lesser diameter of which approximates the lesser diameter of the well in which the same is adapted to be used, substantially as and for the purposes specified.

In testimony whereof I affix my signature, in presence of two witnesses, this 11th day of January, 1905.

ORVIS M. BLOOM.

Witnesses:
WM. D. O'NEILL,
J. H. MCMORROW.

A. S. COOPER.
PACKER FOR OPERATING GAS, WATER, AND OIL WELLS.
APPLICATION FILED JAN. 31, 1910.

1,000,583. Patented Aug. 15, 1911.

Fig. 1.

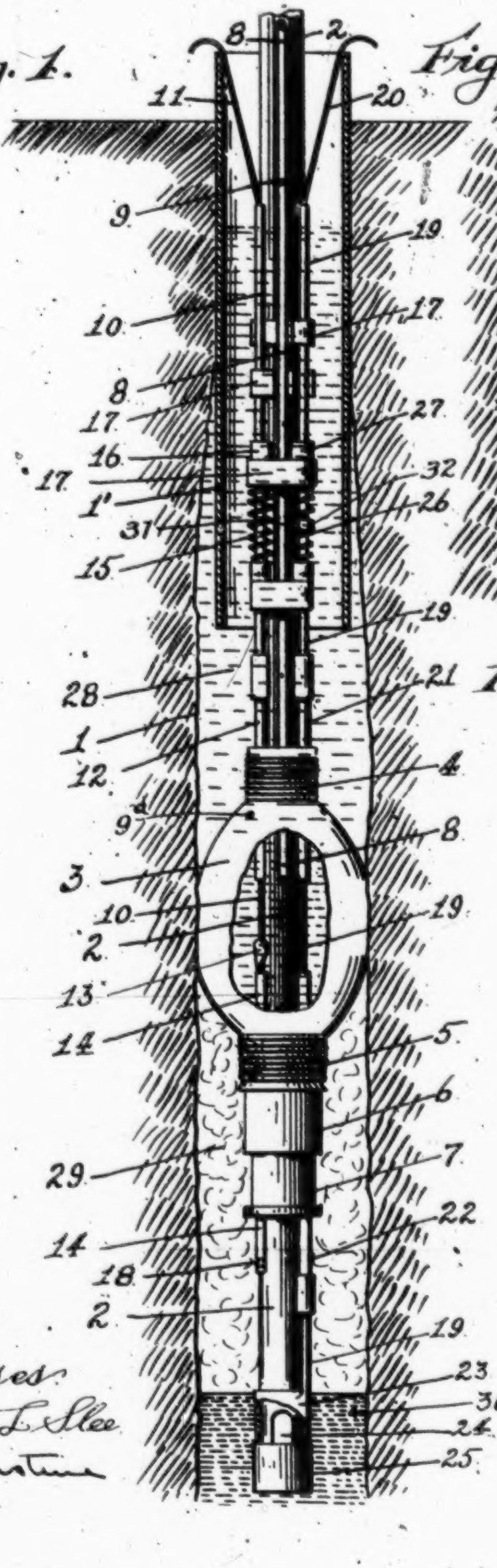


Fig. 2.

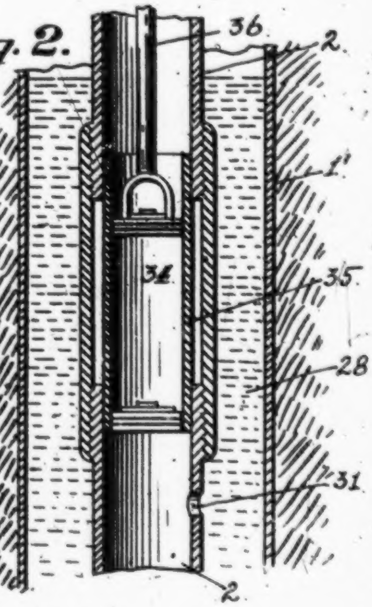
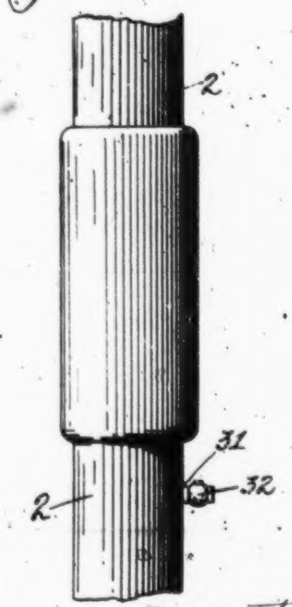


Fig. 3.



Witnesses
Arthur L. Slee
S. Constine

Inventor
Augustus Steiger Cooper
by Wm F Booth
his Attorney

UNITED STATES PATENT OFFICE.

AUGUSTUS STEIGER COOPER, OF LOS OLIVOS, CALIFORNIA.

PACKER FOR OPERATING GAS, WATER, AND OIL WELLS.

1,000,583. Specification of Letters Patent. Patented Aug. 15, 1911.

Application filed January 31, 1910. Serial No. 540,957.

To all whom it may concern:

Be it known that I, AUGUSTUS STEIGER COOPER, a citizen of the United States, residing at Los Olivos, in the county of Santa Barbara and State of California, have invented certain new and useful Improvements in Packers for Operating Gas, Water, and Oil Wells, of which the following is a specification.

My invention relates to the operation of gas, water and oil wells, and it consists in the novel packer and its connections, which I shall hereinafter fully describe together with its objects and manner of use, all of which will be more fully understood by reference to the accompanying drawings in which—

Figure 1 is a sectional elevation, broken away in parts, showing my invention in place in a well. Fig. 2 is a detail, showing a hole or opening in the flow-pipe, which hole communicates with the well above the packer. It also shows a pump let into the flow pipe. Fig. 3 is a detail showing the hole of Fig. 2, controlled by a check valve which may be understood according to its construction to permit the escape but not the entrance to the flow-pipe of liquids or gases, or the reverse of this function.

1 is a well, and 1′ is its casing.

2 is a string or line of pipes extending down into the well from its mouth or surface, and constitutes the flow pipe.

3 is the packer. It is a hollow dilatable and collapsible structure, and it may be made of any suitable flexible material or combination of materials, such, for example, as a textile or woven fabric or elastic rubber, or both. Its normal shape is hose-like, of greater or less diameter. The line of flow pipe 2 passes through the packer, the latter being secured at its ends to the pipe, one end, say the upper end at 4, being fixedly attached, and the other end, at 5, being slidably connected, as by being coupled to a sleeve 6 which is free to slide upon a housing tube 7 fixed on pipe 2. The reason for this connection is that the packer will the more readily expand or dilate to fill the cross-section of the well, if it be permitted to freely contract in a direction at right angles to its lines of expansion. The packer 3 may be of different designs and varying dimensions, to suit the conditions of its use.

8 is a pipe or line of pipes which extends from the surface or mouth of the well and enters and opens into the packer. This pipe is used to expand the packer, which is done by pouring water into its upper end, after the packer is located at the desired point in the well. The pressure in the packer can be regulated in several ways; for example by making holes 9 and 9ª as high above the packer as may be desired; or the pressure may be increased by carrying the pipe 8 higher than the surface or by any direct pressure means. The amount of water poured into the pipe 8 will indicate the size of the cavity filled by packer.

10 is a rod which at the upper end is connected with a rope 11, which is within reach at the mouth of the well. The rod 10 extends parallel with the flow pipe 2 and is guided by suitable collars thereon. It enters the upper end of the packer through a suitable packing gland 12, and carries a valve 13 which controls the discharge pipe 14 of the packer. The valve 13 normally closes the pipe 14 by means of a spring 15 and thus closes the packer and permits it to be expanded. By pulling on rope 11, the valve is lifted, permitting the water to escape from the packer, thus providing for the collapse of the packer, and its movement in or removal from the well. The amount of movement of the valve rod 10 is regulated by a sleeve 16 on the rod which plays between the guide collars 17 of pipe 2. The discharge pipe 14 from the packer passes out through its lower end and down through the housing tube 7 as shown. The lower end of this discharge pipe may be fitted, if necessary, with a check valve 18 which permits the water to escape from the packer but prevents the entrance thereto of gas, oil, or water from the well.

19 is a rod which at its upper end is connected with a rope 20 within reach at the mouth of the well. This rod passes down beside the flow pipe 2 in the guide collars 17, enters the packer through a packing gland 21, passes through the packer and emerges therefrom and through the housing tube 7 through a packing gland 22, and thence extends down to and operates a sleeve 23 constituting an inlet valve which controls the entrance 24 to the pipe 2, just above its end cap 25. The valve 23 is operated by pulling on the rope 20 and is shut by a spring 26 on the rod 19 above. The amount of movement is regulated by a sleeve

27 on the rod 19, which sleeve plays between the guide collars 17 of pipe 2.

28 indicates water above the packer.

29 indicates gas below the packer and 30 is the oil below the packer.

In the detail Fig. 2 I show a hole 31 in the pipe 2, in the water zone, which hole permits the entrance and escape of liquids and gases from the pipe.

In the detail Fig. 3 I show the hole 31 provided with a check-valve 32 which permits the escape from, but not the entrance to the pipe 2 of liquids or gases, or it may be so constructed as to perform the opposite function, namely to permit the entrance to, but not the escape from the pipe 2 of liquids or gases.

In the detail Fig. 2 I also indicate a pump 34 let into the flow pipe 2 between two lengths thereof. The liner 35 of this pump carries the valves, and comes away with them when the sucker rods 36 are drawn.

The device is placed and is moved and removed as follows:—The packer with its immediate connections are lowered in the well to the selected place by the rod 10, and as they are being lowered, the pipe sections forming the line or string of flow pipe 2 and the packer filling pipe 8 are screwed together. When the packer is at the required place, the string of flow pipes 2 is made to support the packer and its connections, and the strain on the rod 10 is relaxed, so that the spring 15 closes the valve 13 which thus seals the packer. Water is then poured into the string of pipes 8, until it causes the packer to expand and fit the casing or the walls of the well, thus practically separating the liquids and gases above the packer from those below it. Upon opening the valve 13, by pulling on rope 11, the packer collapses by the escape of the water therefrom and the packer can then be moved in the well or it may entirely be removed.

I will now describe the uses of the device.

There is, what I may term, continual warfare between natural gas and the liquids (oil and water) for the possession of a well. As there is relatively but a small amount of gas, and an unlimited quantity of water with a small amount of oil floating on its surface, and as the hydrostatic pressure of the water and oil does not change, while the pressure and quantity of gas is constantly decreasing, the water and oil, in the end, will be victorious. They will stifle or drown out the gas and no more can be had, and the well, if then operated for oil will be ultimately exhausted, leaving the water in possession. Wells like the above have been relieved for a time by dropping a small pipe to the bottom of the well; and the pressure of the gas while not strong enough, or in sufficient quantity to raise the column of water in a two or three inch pipe, will raise it through a three-quarters of an inch pipe, by allowing the small pipe to remain open at intervals governed by the amount of water and gas present and the pressure of the gas. The well will then continue to discharge until the amount of, and pressure of the gas decreases, until it is insufficient to operate even the three-quarters of an inch pipe.

It is a well known fact that where surface water, that is, water overlying porous or seamed strata containing oil or gas, has a greater hydrostatic pressure than the hydrostatic pressure exerted on the oil or gas in a well, the oil or gas will be driven away from the bottom of the well. Under these conditions if the packer 3 is successfully located and fixed to the walls of the well below the casing, as is shown by the accompanying drawings, the surface water 28 above the packer will be practically separated and excluded from the gas, oil and water below the packer; then, if the inlet valve 23 is opened, the gas, oil or water will rush into the empty pipe 2, and by this action relieve the pressure below the packer. If enough gas is present and is under sufficient pressure it will come out of solution from the liquids and force part of the oil or water up the pipe 2 to the surface. This action could not take place if the gas were held in solution with the liquids by a tall column of surface water or a tall column of water in the pipe 2. The size of the pipe 2 can be changed so as to accommodate it to the flow of liquid and gas. When the gas is again stifled by the water or oil, the valve 23 can be closed, and the pipe 2 bailed out and after an interval, governed by the known action of the gas and liquids in the well, the valve 23 can be again opened and the operation will be repeated. In this operation there are no sucker rods nor pump in the pipe 2, such as is shown in Fig. 2. If, after the packer is placed in the position as shown in the drawing and the valve 23 is opened, and there is not sufficient gas to force liquid through the pipe 2, the liquid can be removed from below the packer by the pump 34 shown in Fig. 2, or by bailing the pipe 2. By this method of procedure a well can be tested for the presence of oil or gas, by pumping, which could not be done if a flood of surface water were entering the well which the pump or bailer was incapable of removing.

The packer can be kept in the well while it is being operated for gas or oil.

Sometimes a string of well casing contains flaws, or is split, or a hole is worn through the casing by the rubbing of the drilling tools or rope, causing the casing to leak. If the lower end of the string of casing is closed by my packer, and a hole 31, such as I show in Fig. 2, be provided

in pipe 2, and left open, and the water is pumped from the casing above the packer by the pump 34, or bailed from the pipe 2, then if the water in the casing is not lowered by this pumping or bailing operation the casing is defective. Where the casing leaks can be located by moving the packer to different part of the casing.

The packer 3 can be employed to search for a place in the well where the surface water can be permanently shut off by cementing or otherwise. This is done by trying the packer in different parts of the well. If the packer 3 is located partly in the bottom of the casing and partly below the casing, and if the conditions are favorable the surface water can be shut off from the interior of the casing and the bottom of the well. The casing can then be freed from liquids through the hole 31 by the pump 34, or by bailing. The sucker rods 36 and the liner 35 of the pump are then drawn from the pipe 2. By doing this when the valve 23 is opened a large amount of gas would come out of solution from the liquids below the packer before the liquids had formed a column of water or oil in the casing and pipe 2 of a height sufficient to exert a pressure to stifle the flow of gas.

The casing 1′ and pipe 2 can be emptied of liquids by pumping direct from the casing. If this is done the hole 31 is fitted with a check valve 32 as in Fig. 3, which permits the escape of and not the entrance of liquids to the pipe 2.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is—

1. A device for operating gas, water and oil wells, consisting of a dilatable and collapsible packer; means operatable from the mouth of the well to effect the expansion of said packer to cause it to close the cross sectional area of the well; means operatable from the mouth of the well to effect the collapse of the packer, including a spring held valve acting automatically to close an outlet opening in the packer and an operating member extending to the mouth of the well; a flow pipe extending from the mouth of the well, through the packer and into the well below the packer; and means operatable from the mouth of the well to open and close the lower end of the flow pipe.

2. A device for operating gas, water and oil wells, consisting of a dilatable and collapsible packer; a pipe leading from the mouth of the well into said packer, through which pipe a fluid may be passed, to expand the packer and cause it to close the cross sectional area of the well; a relief pipe projecting into the packer and having openings at its opposite ends; a valve for the opening of said pipe within the packer, and connections operatable from the mouth of the well to control the valve of the relief pipe and effect the collapse of the packer; a check valve for the opening at the lower end of the relief pipe; a flow pipe extending from the mouth of the well, through the packer and into the well below the packer; and means operatable from the mouth of the well to open and close the lower end of the flow pipe.

3. A device for operating gas, water and oil wells, consisting of a dilatable and collapsible packer; a pipe leading from the mouth of the well into said packer, through which pipe a fluid may be passed, to expand the packer and cause it to close the cross sectional area of the well; a relief pipe from said packer, a valve and connections operatable from the mouth of the well to control the relief pipe and effect the collapse of the packer; a flow pipe extending from the mouth of the well, through the packer and into the well below the packer; and means operatable from the mouth of the well to open and close the lower end of the flow pipe consisting of a cup-shaped valve sleeved upon the end of the flow pipe, and suitable connections therefrom passing through the packer to the mouth of the well.

4. A device for operating gas, water and oil wells, consisting of a flow pipe; a hollow flexible dilatable and collapsible packer secured to and around said pipe at a point between its ends; the packer having a fixed connection at one of its ends and a slidable connection at its opposite end with the flow pipe; a pipe leading from the mouth of the well into said packer, for introducing a fluid thereto to effect its expansion to cause it to close the cross-sectional area of the well; a relief pipe leading from said packer; a valve in the packer to control the relief pipe and effect the collapse of the packer; operating connections from said valve passing from the packer to mouth of the well; a valve to open and close the lower end of the flow pipe, and operating connections from the valve passing through the packer to the mouth of the well.

5. A device for operating gas, water and oil wells, consisting of a dilatable and collapsible packer; means operatable from the mouth of the well to effect the expansion of said packer to cause it to close the cross-sectional area of the well; means operatable from the mouth of the well to effect the collapse of the packer; a flow pipe extending from the mouth of the well, through the packer and into the well below the packer, said flow pipe having an opening made through its wall, communicating with the well above the packer; and means operatable from the mouth of the well to open and close the lower end of the flow pipe.

6. A device for operating gas, water and oil wells, consisting of a dilatable and col-

lapsible packer; means operatable from the mouth of the well to effect the expansion of said packer to cause it to close the cross-sectional area of the well; means operatable from the mouth of the well to effect the collapse of the packer; a flow pipe extending from the mouth of the well, through the packer and into the well below the packer, said flow pipe having an opening made through its wall, communicating with the well above the packer; a check valve to control said opening; and means operatable from the mouth of the well to open and close the lower end of the flow pipe.

7. In a device for operating gas, water and oil wells, the combination with a flow pipe extending from the mouth of the well, a hollow flexible packer secured around said pipe, said packer having a fixed connection at one end with the flow pipe and a slidable connection at its opposite end therewith, and means for introducing fluid into said packer to distend the same.

8. In a device for operating gas, water and oil wells, the combination with a flow pipe extending from the mouth of the well, a hollow flexible packer secured around said pipe, said packer having a fixed connection at one end with the flow pipe and a collar at the opposite end of the packer slidably engaging over the flow pipe, and means accessible from the top of the well for controlling the admission of fluid to the packer and its discharge therefrom.

9. In a device for operating gas, water and oil wells, the combination with a flow pipe extending from the mouth of the well, a hollow flexible dilatable and collapsible packer secured to the said pipe, one of its ends being fixed and the other having a coupling member adapted to have sliding engagement with the pipe to enable it to yield in a direction at right angles to the lines of its expansion, and means accessible from the top of the well for controlling the admission of fluid to said packer, and its discharge therefrom.

10. In a device for operating gas, water, and oil wells, the combination of a casing, a flow pipe within the casing, a hollow flexible packer mounted upon the flow pipe the same having a fixed connection at one end and a movable connection at its opposite end with the flow pipe, an inlet conduit leading into the upper end of the packer and opening thereinto, an outlet conduit leading from the packer, a valve for the outlet conduit, an operating rod for the valve, a guide for said rod intermediate its ends, and a stop associated with said guide for limiting the movement for said valve.

11. In a device for operating gas, water, and oil wells, the combination of a casi a flow pipe within the casing, a hollow fle ble packer mounted upon the flow pipe t same having a fixed connection at one e and a movable connection at its oppo end with the flow pipe, an inlet conduit le ing into the upper end of the packer opening thereinto, an outlet conduit leadi from the packer, a valve for the outlet co duit, an operating rod for the valve, a gui for said rod intermediate its ends, said fl pipe having an opening in its wall above t packer and within the casing.

12. In a device for operating gas, wa and oil wells, the combination of a casi a flow pipe within the casing, a hollow fle ble packer mounted upon the flow pipe t same having a fixed connection at one e and a movable connection at its oppos end with the flow pipe, an inlet cond leading into the upper end of the pac and opening thereinto, an outlet cond leading from the packer, a valve for t outlet conduit, an operating rod for t valve, a guide for said rod intermediate ends, said flow pipe having an opening its wall above the packer and within t casing, and a check valve for said openi

13. In a device for operating gas, wa and oil wells, the combination with a f pipe extending from the mouth of the w a hollow flexible packer secured around s pipe, means for introducing fluid into s packer to distend the same, the packer ha ing an outlet conduit, a valve for said co duit operable from the mouth of the we and a check valve also associated with s conduit.

14. In a device for operating gas, wa and oil wells, consisting of a dilatable a collapsible packer; means operable from t mouth of the well to effect the expansion said packer to cause it to close the cross s tional area of the well; means opera from the mouth of the well to effect t collapse of the packer; a flow pipe extendi from the mouth of the well, through t packer and into the well below the pac said flow pipe having an opening m through its wall at a point above the pack and communicating with the well; and means operable from the mouth of the well to open and close the lower end of the flow pipe.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

AUGUSTUS STEIGER COOPER.

Witnesses:

DANIEL S. BRANT,

DALLAS D. DAVIS.

E. H. COX.
DEVICE FOR TESTING WELLS FOR OIL, GAS, &c.
APPLICATION FILED JUNE 24, 1920.

1,347,534.

Patented July 27, 1920.

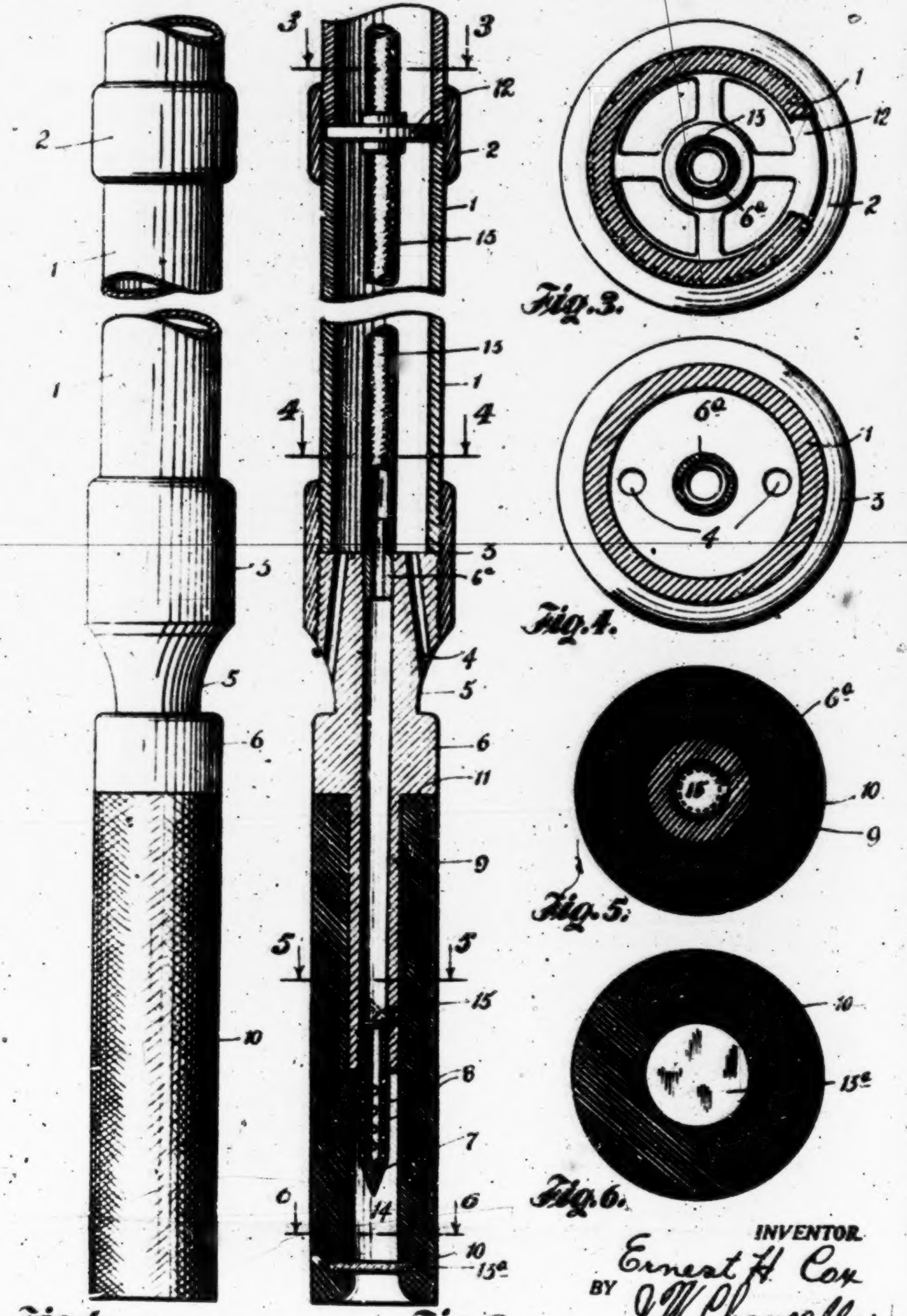


Fig.1. Fig. 2. Fig.3. Fig.4. Fig.5. Fig.6.

INVENTOR
Ernest H. Cox
BY J.W. Chancellor
ATTORNEYS

UNITED STATES PATENT OFFICE.

ERNEST H. COX, OF DUNCAN, OKLAHOMA, ASSIGNOR OF ONE-HALF TO J. W. CHANCELLOR, OF BOWIE, TEXAS.

DEVICE FOR TESTING WELLS FOR OIL, GAS, &c.

1,347,534. Specification of Letters Patent. Patented July 27, 1920.

Application filed June 24, 1920. Serial No. 391,302.

To all whom it may concern:

Be it known that I, ERNEST H. COX, a citizen of the United States, residing at Duncan, in the county of Stephens and State of Oklahoma, have invented certain new and useful Improvements in Devices for Testing Wells for Oil, Gas, &c., of which the following is a specification.

This invention relates to improvements in well drilling, particularly to wells drilled by the rotary syst m, and in such connection it relates more particularly to a device for testing wells in order to ascertain if oil, water, gas, and other liquids are under the path of the drill or in proximity thereto, that is the stratum which has not been disturbed or only partially disturbed by the drill bit; to provide means for procuring and bringing to the surface a small quantity or sampling test of such oil, sand, water or whatever is in the path of the drill bit for inspection and analysis, and to also provide an efficient and satisfactory means for complete separation of the water, mud, slush, etc., in the hole above the point from which the test is to be taken from the quantity to be investigated and analyzed, to thereby arrive at an accurate determination of the value of the drilled hole.

Such contrivances as are now in use so far as I am aware are mainly intended to ascertain the whereabouts or quality, etc., of any gas, oil, or water, which may reside in the bottom of the drilled hole and crude attempts have been made in ascertaining such information to separate the water and slush in the drill casing or hole from the liquid, gas or what not which may reside in the well, to bring it in its uncontaminated state to the surface.

My invention will be more fully understood from the following description, taken in connection with the accompanying drawings, forming part hereof, in which—

Figure 1 is a vertical elevational view of the lower end of a drill stem embodying my invention.

Fig. 2 is a longitudinal sectional view thereof, and

Figs. 3, 4, 5 and 6 are cross sectional views, respectively, taken on lines 3, 4, 5 and 6, of Fig. 2.

Referring more particularly to the drawings, 1 denotes a section of a drill stem with the usual couplings 2, the drill stem shown in broken formation for better illustration.

The lower end of the drill stem 1 is threaded to receive the device for making the test. This device has a head 3 screw-threaded onto the lower end of the drill stem 1 and the head 3 is channeled or bored as at 4—4 to provide a passage for water, slush, etc., when the drill stem is lowered into the well, the channels having an oblique relationship to the drill stem as depicted in Fig. 2. The head 3 has a curved neck 5, the head 3 and neck 5 being formed integrally with the body 6. The body 6 is longitudinally channeled as illustrated at Fig. 2 and on the lower end is a sharp pointed plunger 7 for piercing the formation at the bottom of the hole. The sharp pointed plunger 7 is perforated as at 8—8 so that liquid, gas, etc., may enter. The lower portion of the device has its diameter reduced into an extended nipple-like member 9 around which is stretched or placed a rubber nose 10 and which nose abuts a shoulder 11.

Between adjacent ends of the drill stem sections 1 is interposed a ring 12 or centralizing means for a flexible metallic hose 13. The hose 13 is screwed onto the upper end of the nipple 6ᵃ. The rubber nose 10 as will be noted by reference to Fig. 2 extends beyond the lower end of the nipple-like member 9 and its opening 14 is closed preferably by a piece of glass or brittle material 13ᵃ.

In operation the drill stem carrying the device is lowered into the hole to within a short distance of the bottom where it is then dropped at sufficient speed to cause the nose 10 to forcibly strike the bottom of the hole. On such impact the sharp pointed member 7 is forced downward and on breaking the closure 13ᵃ is plunged into the bottom of the hole. The impact of the heavy drill stem will also cause the rubber nose 10 to be forced against the walls of the well and effectually shut off the water and slush in the hole from the opening 14. As the liquid enters this opening it passes through the perforations 8—8 into the hollow interior of the sharp pointed member 7 and flows upward and is held in the flexible hose 13 by a check valve 15 of any suitable construction. The drill stem may then be removed from the hole for inspection of the test.

It is obvious that on striking gas that the gas will pass upward through the member 7 and into the metallic hose 13 to the top of the well without the necessity of removing the drill stem from the well. Also that minor changes may be made in the construction of the device without departing from the principle or spirit of the invention.

Having thus described the nature and objects of my invention, what I claim as new and desire to secure by Letters Patent is—

1. In a device of the character described, a substantially cylindrical member adapted to be attached to the lower end of a drill stem, said member having a head and a neck and body, said head and neck provided with a plurality of channels traversing the head and neck in oblique relationship to the body, and opening outward and downward at the neck of the body to admit water, slush, etc., when the drill stem is lowered into the well, the lower end of the body reduced in diameter and extended into a nipple-like formation, a "packer" or nose thereon, a channel through the head and nipple-like formation, a plunger with a pointed perforated end extending from the lower end thereof, a flexible tube connected to the head and a closure over the bottom of the nose.

2. In a device of the character described, a substantially cylindrical body with a head and neck for connection to a drill stem, oblique channels traversing the head and neck, said body reduced in diameter below the neck into a relatively long nipple or shank, a channel through the shank and extending through the head and neck, a perforated plunger with a check valve, a flexible hose connected thereto, a nose or "packer" receivable on the shank, and a closure on the bottom of the "packer" or nose, all arranged so that on impact in the hole the "packer" or nose will expand against the walls of the well, the plunger will pierce or break the closure and allow the fluid or gas to pass into the plunger and flexible hose.

In testimony whereof I have signed my name to this specification.

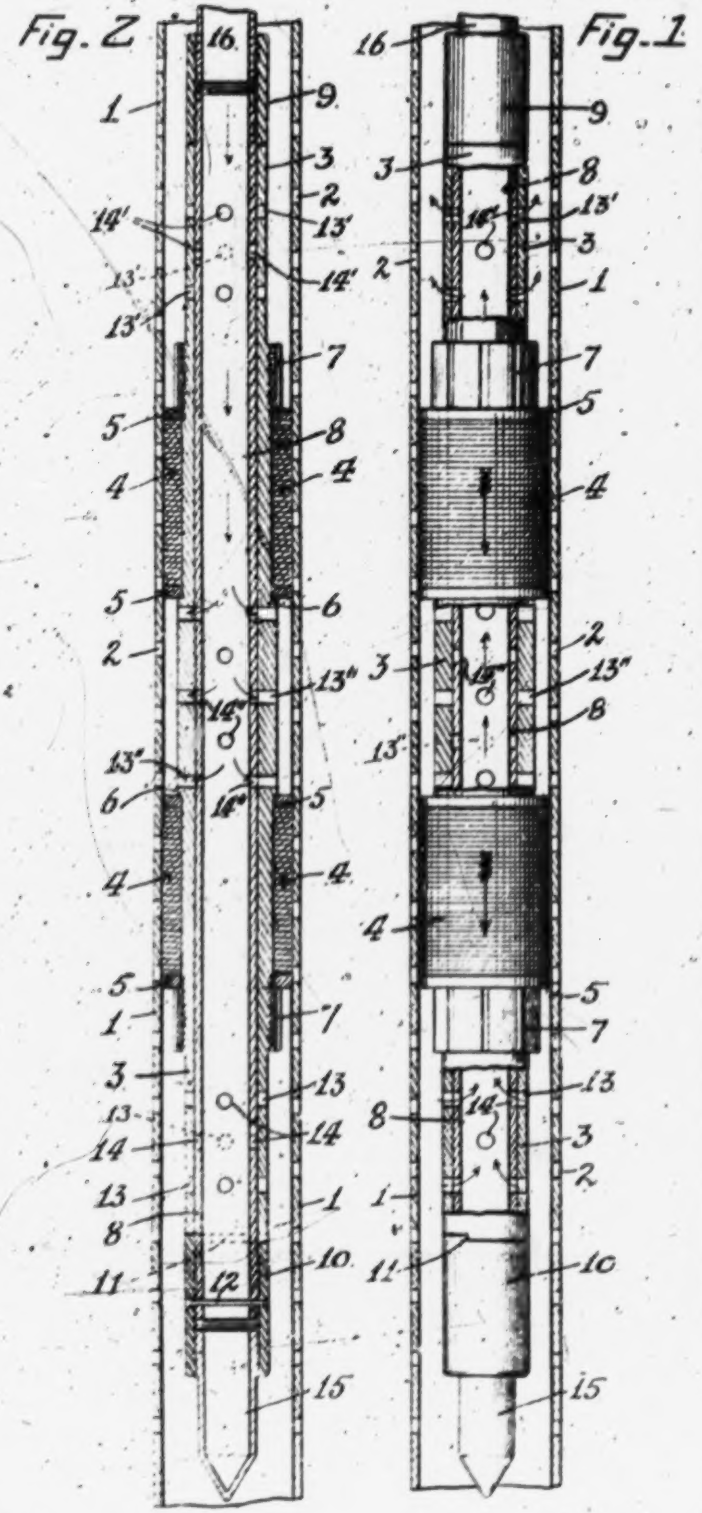
ERNEST H. COX.

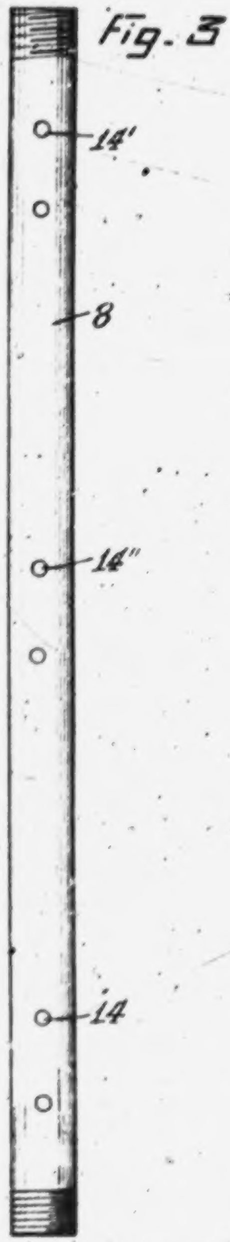
Nov. 20, 1923 1,474,630

A. L. HALLIDAY

PERFORATION CLEANER FOR OIL WELL CASINGS

Filed March 25, 1922





Inventor
Alonzo Lewis Halliday
By Scott & Scott
attorneys

Patented Nov. 20, 1923. **1,474,630**

UNITED STATES PATENT OFFICE.

ALONZO LEWIS HALLIDAY, OF OIL CENTER, CALIFORNIA.

PERFORATION CLEANER FOR OIL-WELL CASINGS.

Application filed March 25, 1922. Serial No. 546,587.

To all whom it may concern:

Be it known that I, ALONZO LEWIS HALLIDAY, a citizen of the United States, residing at Oil Center, in the county of Kern and State of California, have invented certain new and useful Improvements in Perforation Cleaners for Oil-Well Casings, of which the following is a specification.

My invention relates generally to oil-well devices and appliances, and particularly to a device for cleaning out the perforations of a well-casing.

The object of my invention is to provide a simple and effective appliance for this purpose, by the use of which the clogging accumulations in the perforations may be dissolved or disintegrated, and removed by being forced out into the formation.

To this end my invention consists in the novel perforation cleaner which I shall hereinafter fully describe by reference to the accompanying drawings, in which—

Fig. 1 is an elevation, partly broken in vertical section, of my device, showing it in the well casing, the valve controls being in position to permit the cleaner to be lowered or lifted without resistance from the fluid in the well.

Fig. 2 is a vertical section of the device showing the valve controls in position for discharging the perforation-cleaning fluid introduced when the device is in operation.

Fig. 3 is an elevation of the valve-tube.

1 is the well casing, showing that portion which includes the perforated area, the numeral 2 indicating the perforations.

The cleaner appliance comprises a tubular or hollow mandrel 3, to the exterior of which are fitted two packers 4 spaced any predetermined distance apart. A simple and practical fitting of these packers consists in binding them between washers 5 and shoulders 6, by means of nuts 7 screwed upon the mandrel.

Fitted snugly in the smooth bore of the mandrel 3 is an inner tube 8, which constitutes the valve-control.

Upon the upper end of the valve tube is screwed a collar 9, and upon its lower end is screwed a collar 10, the ends of said collars abutting against the upper and lower ends of the mandrel, respectively, thereby closing the mandrel, and confining the tube within it; but said tube is adapted to be oscillated therein on its axis. A stop feature for this oscillatory axis-movement of the tube 8 is provided, which feature, in its present form, consists of the interengaging shoulders 11, formed by the arcuate cutting away of the abutting faces of the bottom of the mandrel and top of the collar 10. A pin 12, Fig. 2, is riveted through the valve tube and the collar 10 to fix the collar on the tube.

In the wall of the mandrel 3, below the lower packer are ports 13, and in the wall of the valve tube 8 are ports 14 which, by the oscillatory movement of the tube, are thrown into and out of register with the mandrel ports.

Similarly, in the mandrel and valve-tube, above the upper packer are ports 13′ and 14′, respectively, corresponding in position to the lower ports 13 and 14, so that both sets of ports are moved into and out of register simultaneously, by the turning of the valve-tube. In the walls of the mandrel and the valve-tube, in the area between the two packers 4, are ports 13″ and 14″ respectively. These last named ports are, however, placed relatively to the first named ports, in such wise that when the upper and lower sets of ports are opened the intermediate set is closed and vice-versa; and at an intermediate position all three sets are closed.

The lower end of the valve-tube 8 is closed by a plug 15 screwed to the lower collar 10, said plug serving also as a rest in case the device is lowered to the bottom of the well.

To the upper collar 9 is connected the tubing string 16.

In using the cleaner, the tubing string 16 is connected at the derrick to a discharge line from a force pump, by a swivel connection, the tubing being suspended by means of elevators hooked onto the regular tubing-pulling equipment, but as these parts are not necessary for an understanding of my present invention, I have not herein shown them.

My device being, as above stated, connected to the bottom of the tubing string, is lowered into the well to the desired depth. Due to the fact that the tight fit of the packers 4 in the casing 1, prevents the mandrel 3 from turning, the valve tube 8 may be turned in the mandrel (by turning the tubing string at the derrick) until it is arrested by the stop 11, and in this position the lower set of ports 13 and 14 and the upper set of

ports 13′ and 14′ are in respective register, as shown in Fig. 1, so that the fluid in the well may pass in through the ports 13 and 14 and up in the inner tube 8, and out through the ports 13′ and 14′ as indicated by the arrows. By such relief passage for the fluid in the well, the device may be lowered easily; otherwise, the packers 4 would act as pistons and would have to be forced down against pressure. When the device has been lowered to the desired depth, the valve tube is turned back again to its stop, thereby closing the ports 13, 14, 13′ and 14′ and opening the intermediate ports 13″ and 14″, in the area between the two packers, as shown in Fig. 2. Then fluid is pumped down through the tubing string 16 and this fluid, discharging through the ports 13″ and 14″ of the cleaner, clears the perforations 2 in the casing 1, in the zone or region lying between the two packers, said fluid being prevented from discharging otherwise, because the valve tube 8 is closed except at the ports 13″ and 14″.

The volume and pressure of the fluid pumped out through the relatively restricted space between the packers is effective to remove or dissolve the clogging accumulations from the casing perforations 2 and from the outer wall of the casing.

By vertically moving the cleaner at intervals, a distance determined by the length of the space between the packers, and applying fluid pressure, as mentioned, the entire section of well-casing perforations may be cleaned.

A further advantageous feature in the operation of the cleaner is that by turning the inner tube only partially all the port sets may be closed. The fact that they are closed may be indicated by a pressure gage on the force pump line at the derrick. After this pressure has reached a desired height, the inner tube may be turned farther to open the ports 13″ and 14″; and by thus suddenly releasing this high pressure, it will serve more effectively to remove the clogged formation from the casing perforations.

Upon removing the device from the well, the upper and lower sets of ports are again opened to permit the fluid above the top packer and that which stands in the tubing string to flow back into the well, and thus prevent the pulling of a wet string. Any fluid such as oil, distillate or water may be used in the operation of the device, to suit the particular difficulty encountered. Clean crude oil of low gravity and slightly warm will be found effective, as it acts to suspend in solution the formation with which it comes in contact, and so allows it to flow back into the well, to be pumped out.

Another point of advantage lies in the fact that by the use of this device any imperforate spaces of the well casing, which sometimes happen, by reason of a defective perforating machine, may be located, as such spaces will show on the pressure gage.

I claim:—

1. A perforation cleaner for well-casing comprising a hollow mandrel having ports in its side; a pair of spaced packers carried by the mandrel one on each side of its ports and adapted for contact with the interior of the well casing to close an annular space between the mandrel and casing; and a valve member seated within said mandrel for controlling its ports.

2. A perforation cleaner for well-casing, comprising a hollow mandrel having ports in its side; a pair of spaced packers carried by the mandrel one on each side of its ports and adapted for contact with the interior of the well casing to close an annular space between the mandrel and casing; an axially oscillatory hollow valve member fitted within and closing the mandrel, said valve member having ports in its side adapted to move into and out of register with the ports in the mandrel; and a tubing string connected with and adapted to pass fluid under pressure into the valve member.

3. A perforation cleaner for well-casing comprising a hollow mandrel having upper, lower and intermediate ports in its side; a pair of spaced packers carried by the mandrel one between the upper and intermediate ports and one between the lower and intermediate ports, said packers being adapted for contact with the interior of the casing to close an annular space between the mandrel and casing; an axially oscillatory hollow valve-member fitted within and closing the mandrel, said valve member having upper, lower and intermediate ports in its side adapted to move into and out of register with the corresponding ports of the mandrel, the upper and lower ports of the mandrel and valve member relatively corresponding, whereby their control is simultaneous, and the intermediate ports being angularly offset relatively to and their control alternative with said upper and lower ports; and a tubing string connected with and adapted to pass fluid under pressure into the valve member.

4. A perforation cleaner for well-casing comprising a hollow mandrel having upper, lower and intermediate ports in its side; a pair of spaced packers carried by the mandrel one between the upper and intermediate ports and one between the lower and intermediate ports, said packers being adapted for contact with the interior of the casing to close an annular space between the mandrel and casing; an axially oscillatory hollow valve-member fitted within and closing the mandrel, said valve member having upper, lower and intermediate ports in its side adapted to move into and out of register-

ter with the corresponding ports of the mandrel, the upper and lower ports of the mandrel and valve member relatively corresponding whereby their control is simultaneous, and the intermediate ports being angularly offset relatively to and their control alternative with said upper and lower ports; a stop for defining the limits of oscillation of the valve member; and a tubing string connected with and adapted to pass fluid under pressure into the valve member.

5. A perforation cleaner for well casing comprising a member to be suspended within the casing and adapted for discharging a fluid under pressure against the perforated section thereof; means seated within said member for controlling the discharge therefrom and means for closing the space in the casing around said member in the zone of its discharge.

6. A perforation cleaner for well casing comprising a member to be suspended within the casing and adapted for discharging a fluid under pressure against the perforated section thereof; an axially oscillatory valve seated within said member for controlling the discharge therefrom; and means for closing the space in the casing around said member in the zone of its discharge.

In testimony whereof I have signed my name to this specification.

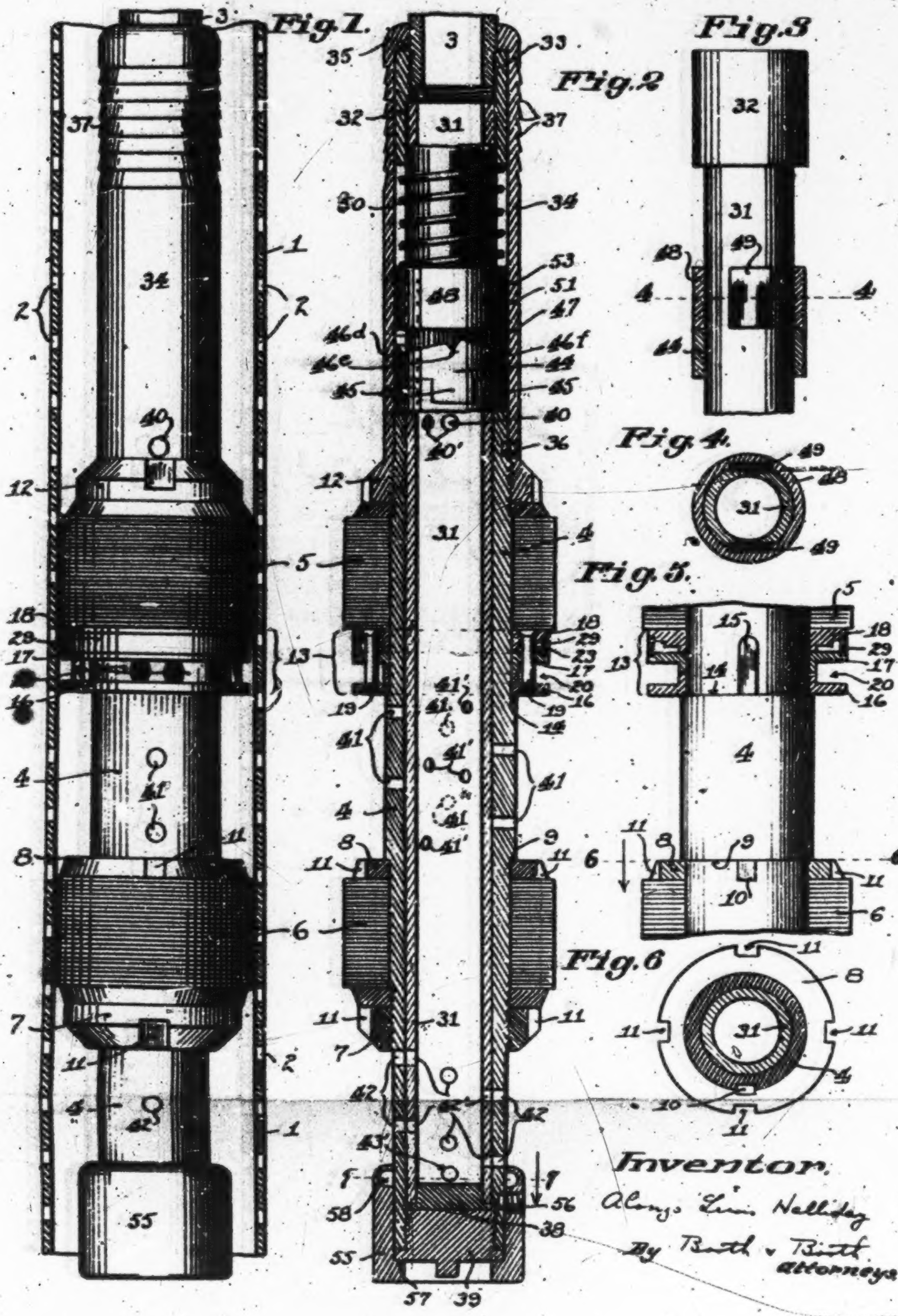
ALONZO LEWIS HALLIDAY.

Oct. 7, 1924. 1,510,669

A. L. HALLIDAY

PERFORATION CLEANER FOR OIL WELL CASINGS

Filed April 3, 1923 3 Sheets-Sheet 1



Inventor.

Alonzo Lewis Halliday

By Booth & Booth

Attorneys

Oct. 7, 1924. 1,510,669

A. L. HALLIDAY

PERFORATION CLEANER FOR OIL WELL CASINGS

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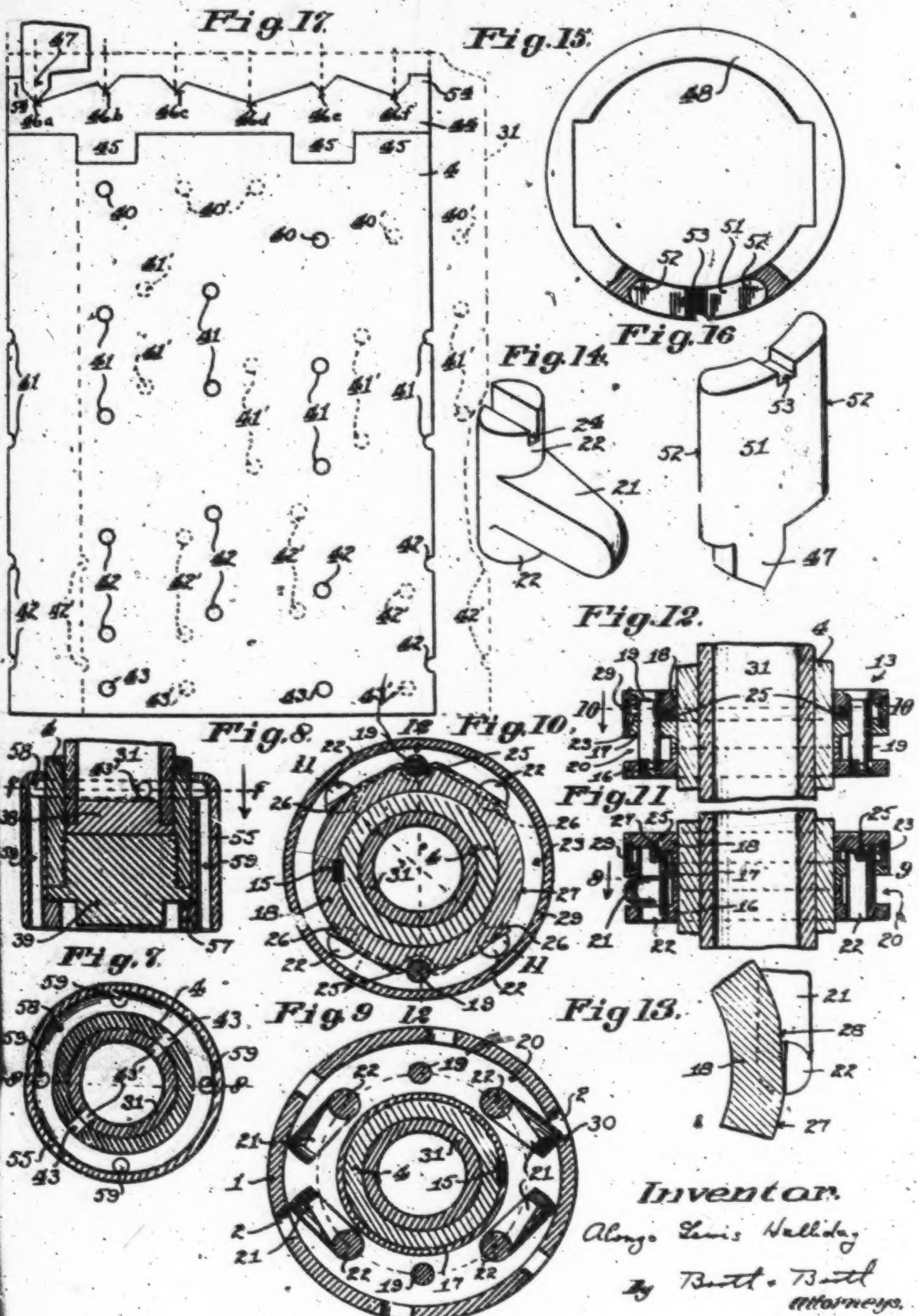


Oct. 7, 1924. 1,510,669

A. L. HALLIDAY

PERFORATION CLEANER FOR OIL WELL CASINGS

Filed April 3, 1923 3 Sheets-Sheet 3

Fig. 18.

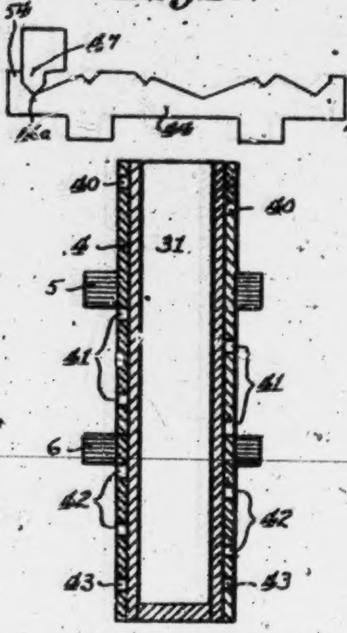


Fig. 19

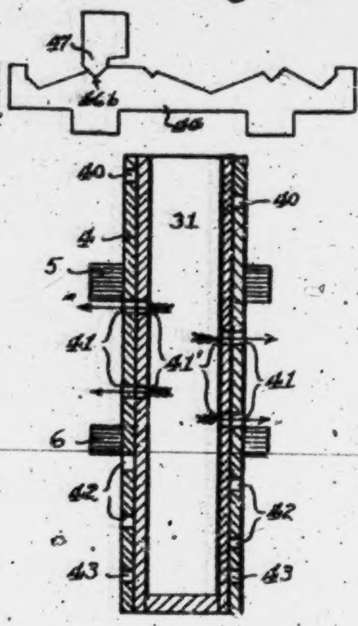


Fig. 20

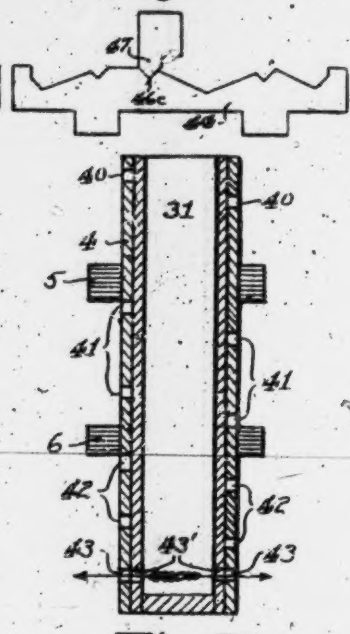


Fig. 21

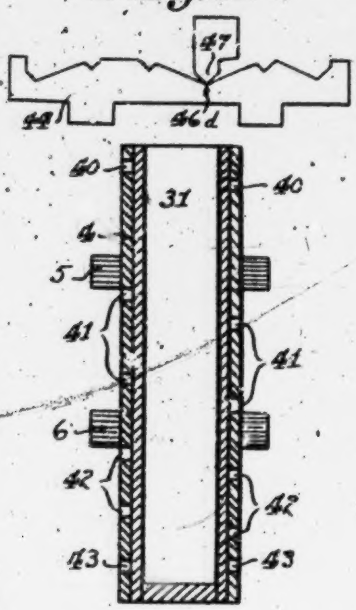


Fig. 22

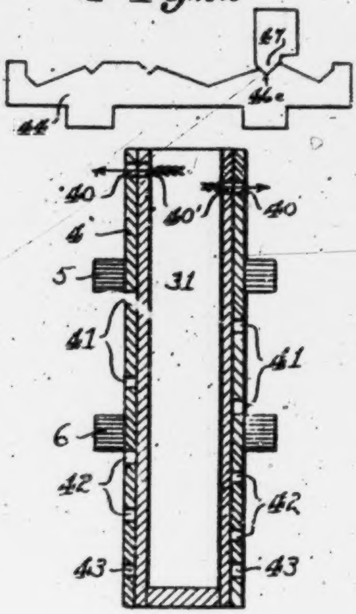
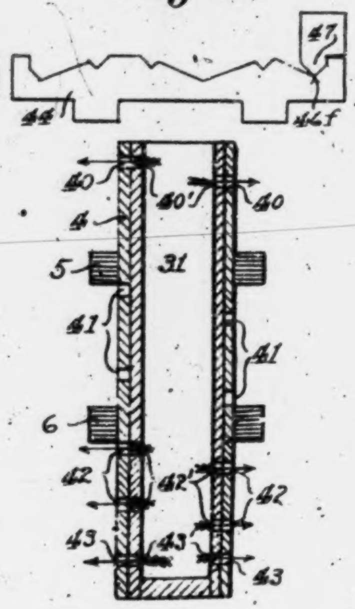


Fig. 23.



Inventor.

Alonzo Lewis Halliday

By Booth & Booth, Attorneys.

Patented Oct. 7, 1924. **1,510,669**

UNITED STATES PATENT OFFICE.

ALONZO LEWIS HALLIDAY, OF OIL CENTER, CALIFORNIA.

PERFORATION CLEANER FOR OIL-WELL CASINGS.

Application filed April 3, 1923. Serial No. 629,631.

To all whom it may concern:

Be it known that I, ALONZO LEWIS HALLIDAY, a citizen of the United States, residing at Oil Center, in the county of Kern and State of California, have invented certain new and useful Improvements in Perforation Cleaners for Oil-Well Casings, of which the following is a specification.

My invention relates generally to devices for cleaning oil-well casings in the region of their perforated sections and dislodging and disintegrating caked formation which lies around and in close proximity to the exterior surface of the casing.

My invention relates particularly to and consists in certain novel improvements in the perforation cleaner disclosed in my United States Letters Patent No. 1,474,630, issued Nov. 20, 1923, upon my application Serial No. 546,587, filed March 25, 1922, which said disclosure will necessarily be repeated herein to an extent required for a full understanding of said improvements.

These improvements concern the arrangement and selective control of the ports through which the cleaning fluid is discharged, the stop feature by which the several positions of the selective control valve member are defined, a means for better holding the tool against possible rotation in the casing while operating said valve member, and changes in the construction of the several parts of the device which make for greater strength and ease of operation and longer life, all of which will be more fully described hereinafter with the understanding that changes may be made in the form and construction of the device as herein described and illustrated, without departing from the spirit of the invention as expressed in the claims hereto appended.

The object of my present invention is to provide a simple and effective well cleaner, which is most universally practical owing to its capability of coping with the different conditions encountered in different wells and in different localities, and which moreover can be readily understood by and is safe to entrust to the average well worker, and may be used in connection with the customary oil field equipment. More specifically, the object of my invention is to provide a well cleaner which may be used not only for cleaning the perforations in the well casing and for loosening the caked formation immediately exterior thereto, in the manner described in my said pending application Ser. No. 546,587, but also for loosening and removing caked formation within and around the bottom of the casing, such for example as the caked mud which collects in the bottom and interferes with the production of a newly drilled well in which mud has been used in connection with the drilling operation, and for dislodging and removing any accumulated formation which may have settled above the device, and which would tend to prevent its removal. This latter function of my device may also be used to introduce fluid into the well above the cleaner, to counter-act, by its weight, the effect of fluid pressure below the cleaner, which might tend to elevate said cleaner and the tubing string to which it is secured. Further objects of my present invention are to provide means incorporated within the device itself to enable the operator at the surface of the ground accurately to determine the several positions of the selective control valve; to provide means for effectively enclosing the mechanism to prevent the ingress of sand thereinto; to provide a simple construction for relieving the control valve member of the weight of the entire device; and to provide means for enabling the device to be pulled out with the usual fishing tool in case it should become detached from the tubing string.

My well cleaner may be allowed to remain connected with the lower end of the tubing string in a flowing well, or with the bottom of the pump in a pumping well, the fluid passing through the device and into the pump or tubing string, thus saving the time and expense involved in pulling the tubing string whenever it becomes necessary to clean the perforated section of the casing.

My invention will now be fully described with reference to the accompanying drawings, wherein:

Fig. 1 is an elevation of my device suspended within the perforated section of a well casing, the casing being shown in section.

Fig. 2 is a partial central longitudinal section of my device.

Fig. 3 is an elevation of the upper portion of the valve tube, the stop rings being shown in section.

Fig. 4 is a horizontal section taken on the line 4—4 of Fig. 3.

Fig. 5 is an elevation of the central por-

tion of the mandrel, the packers and retaining dog mechanism being shown in section, and certain portions of the latter being omitted for the sake of clearness.

Fig. 6 is a horizontal section taken in the direction of the arrow on the line 6—6 of Fig. 5.

Fig. 7 is a horizontal section of the fluid director secured to the lower end of the mandrel, and is taken in the direction of the arrows on the lines 7—7 of Figs. 2 and 8.

Fig. 8 is a vertical section of the same taken on the line 8—8 of Fig. 7.

Figs. 9 and 10 are horizontal sections of the mandrel retaining dog mechanism, taken on two different planes represented respectively by the lines 9—9 of Fig. 11 and 10—10 of Fig. 12.

Figs. 11 and 12 are vertical sections of the same, taken respectively on the lines 11—11 and 12—12 of Fig. 10.

Fig. 13 is a horizontal sectional detail, enlarged, of the stop for limiting the outward movement of one of the retaining dogs.

Fig. 14 is a perspective view of one of the retaining dogs.

Fig. 15 is a part sectional plan, enlarged, of the stop pin holder ring shown in the upper portion of Figs. 2 and 3.

Fig. 16 is a perspective view of the stop pin.

Fig. 17 is a diagrammatic projection of the stop ring cam and the mandrel, showing the relative positions of the stop ring notches and the mandrel discharge ports. The ports of the valve tube are also shown, projected, in dotted lines.

Figs. 18 to 23, inclusive of both, are diagrams showing the arrangement of the open and closed ports in each operative position of the valve tube, the stop pin and a projection of the stop ring cam being shown in the upper portion, and a diagrammatic section of the mandrel and valve tube in the lower portion, of each figure.

In the drawings, and referring for the moment to Figs. 1 and 2 thereof, the reference numeral 1 designates the perforated section of a well casing, the perforations being designated by 2. 3 is the tubing string, to the lower end of which my improved perforation cleaner is secured, and by means of which it is supplied with the cleaning fluid, and its valve member operated. The cleaner itself comprises a tubular mandrel 4, which carries upper and lower spaced packers 5 and 6 respectively, formed of any suitable resilient material adapted to fit closely within the casing 1 to close the space between said casing and the mandrel 4. The lower packer 6 is retained between a nut 7, screwed upon the mandrel 4, and a ring 8 which bears against a shoulder 9 formed upon said mandrel and which is prevented from turning thereupon by a key 10, Fig. 5. Both the nut 7 and the ring 8 are formed with notches 11 for the engagement of a spanner wrench for convenience in assembling, and to prevent mutilation of the parts through the enforced use of pipe wrenches. By holding the keyed ring 8 with a spanner wrench, the entire mandrel may be held stationary while assembling or dismantling its associated threaded parts.

The upper packer 5 is similarly mounted between a notched nut 12, threaded upon the upper end portion of the mandrel, and a retaining dog mechanism indicated collectively in Figs. 1, 2, and 5 by 13, and which bears against a shoulder 14 formed upon said mandrel. The retaining dog mechanism 13 is provided for the purpose of engaging the perforations 2 of the casing 1, and thereby to prevent the rotation of the mandrel 4 when the cleaner is in functional position; and is therefore prevented from rotating upon the mandrel 4 by a key 15, Fig. 5. Said retaining dog mechanism is illustrated in detail in Figs. 9 to 14, and comprises three adjacent rings 16, 17 and 18, encircling the mandrel 4 and keyed thereto as above stated, and held together by screws 19, as shown in Fig. 12. An annular channel 20 is formed between the lower ring 16 and the middle ring 17, and in this channel are mounted horizontally swinging dogs 21. There are four such dogs shown in Fig. 9, arranged in pairs, the members of each pair being disposed oppositely to each other. However, the number and arrangement of the said dogs 21 may be changed if practical considerations render it expedient, the essential point being that at least one such dog must face in each direction.

The dogs 21 are provided with oppositely extending hubs 22, Figs. 11 and 14, which extend through and are journaled in holes in the spaced portions of the rings 16 and 17. The upper hub 22 of each dog extends into a channel 23 formed between the middle ring 17 and the upper ring 18, and is provided with a transverse slot 24, into which is fitted the end portion of a spring 25. There are two such springs for the four dogs arranged as shown in Fig. 10, each spring engaging two dogs. The springs 25 are retained in position endwise by being bent part way around the screws 19 at their center portions, and by having their ends bent over outside the hubs 22, as shown at 26 in Fig. 10. The upper ring 18 retains said springs within the slots 24, as shown in Figs. 10 and 11. The outer half of the upper hub 22 of each dog 21 extends farther than the inner half, and is adapted to engage a shoulder 27 formed upon the under surface of the upper ring 18, to limit the outward movement of the

dog, as shown in Figs. 11 and 13. Said shoulder 27 is flattened, as at 28, to permit the dog to have sufficient swinging movement. An annular guard 29, Figs. 10 and 12, encloses the space 23 between the rings 17 and 18 to prevent foreign matter from entering.

The dogs 21 are normally held in such position by the springs 25 that their outer ends project slightly beyond the rings 16 and 17, and bear against the inside of the casing 1, and in this position they are ready to engage the perforations 2, as shown at 30 in Fig. 9. Such an engagement as that shown at 30 would prevent the mandrel 4 from being moved within the casing in a clock-wise direction, and a slight movement thereof in the opposite direction would cause one of the oppositely disposed dogs to similarly engage a perforation. Thus the mandrel 4 is effectively locked against all but a slight rotative movement in either direction. The ends of the dogs 21 are rounded in a vertical plane as shown, so that any vertical movement of the device causes the engaged dogs to be moved inwardly and freed from the casing perforations. This rounded form of the dogs 21 also prevents them from catching upon obstructions or joints in the casing when the device is being raised or lowered. The dogs 21 are also rounded in a horizontal plane, on an arc whose center coincides with the center of the hubs 22, so that there is no danger of said dogs becoming jammed in case two or more happen to engage perforations at the same time.

Returning now to Fig. 2, the mandrel 4 carries within it a rotatable tubular valve member 31, which has a sleeve 32 permanently secured to its upper end, and said sleeve is provided with interior threads for engagement with the lower end of the tubing string 3, as shown at 33. The nut 12 of the upper packer 5 carries an integrally formed sleeve 34, which extends upwardly, inclosing the parts within, and is provided with an interior shoulder 35 adapted to engage the upper end of the valve coupling sleeve 32. Thus the entire weight of the device is carried by said coupling sleeve 32, the outer sleeve nut 34—12, and the mandrel 4, rather than by the valve tube 31. A set screw 36 is provided for retaining the sleeve nut 34—12 in position. The upper end portion of the outer sleeve 34 is provided on its exterior with flutes or beards 37, to enable the device to be engaged by a fishing tool in case the tubing string 3 should become detached. The lower end of the valve tube 31 is permanently closed by a plug 38, and the lower end of the mandrel 4 is closed by a removable plug 39, which forms a bearing for the bottom of the valve tube 31.

The mandrel 4 is provided with four distinct sets or groups of discharge apertures or ports, which are selectively controlled by the partial rotation, or more properly the oscillation, of the valve tube 31, said valve tube having similar groups of ports adapted to be moved into and out of register, by said oscillation, with the ports of the mandrel. All the ports of each group are controlled simultaneously. The preferred arrangement of the mandrel ports is shown in full lines in the diagram of Fig. 17, which represents the entire mandrel cylinder projected, but it is to be understood that the number and arrangement of such ports may be varied to suit structural requirements.

The upper group of ports 40 are positioned above the upper packer 5, and register permanently with similar ports in the sleeve 34. There are preferably two ports in this group, spaced 180 degrees apart, and on different levels. One such port 40 is shown in Fig. 2 and the other in Fig. 1. The center group is positioned between the upper packer 5 and the lower packer 6, and preferably comprises eight ports 41, arranged 90 degrees apart in two inclined planes, as shown in Fig. 17, the ports of the two planes being in vertical alignment. The third group is positioned below the lower packer 6, and preferably comprises seven ports 42, disposed similarly to and in vertical alignment with the ports 41. The fourth group is positioned at the lower end of the mandrel, below the third group, and preferably comprises two ports 43 spaced 180 degrees apart and in the same horizontal plane.

The preferred arrangement of the valve tube ports is shown in dotted lines in Fig. 17. The upper group preferably comprises four ports 40′ disposed in two horizontal planes corresponding with the planes of the mandrel ports 40, the two ports 40′ in each plane being spaced 60 degrees apart, and the ports in the two planes being spaced respectively 180 degrees apart. The second group comprises eight ports 41′, arranged in a manner similar to the mandrel ports 41. The third group comprises seven ports 42′, likewise arranged similarly to the mandrel ports 42. The fourth group comprises two ports 43′, spaced by 180 degrees in the same horizontal plane. This relative arrangement of the mandrel and valve ports is such that the several desired combinations of open and closed ports occur at regular intervals of 60 degrees in the rotation of the valve tube 31, as will be further explained hereinafter. There are, therefore, six effective positions of the valve tube, which positions are located and determined, by the operator at the surface of the ground, by the following mechanism.

At the upper end of the mandrel 4 is a sleeve or ring 44, Fig. 2, freely surrounding the valve tube 31, and prevented from rotating by inter-engaging tongues 45 formed upon itself and said mandrel. The upper edge of this ring 44, hereinafter called the stop ring, is formed with six notches, spaced 60 degrees apart to correspond with the six effective positions of the valve tube 31. These six notches, which are designated consecutively as 46^a, 46^b, 46^c, 46^d, 46^e, and 46^f and clearly shown in the projection of the stop ring 44 in the upper portion of Fig. 17, are adapted to be engaged by a stop pin 47 carried by a sleeve 48, Figs. 2, 3 and 4. Said sleeve 48 is free to slide vertically on the valve tube 31, but is prevented from turning thereupon by feathers 49 preferably formed integrally with said valve tube. A spring 50, interposed between the coupling sleeve 32 and said sleeve 48, keeps the stop pin 47 in engagement with the upper notched edge of the stop ring 44. The stop pin 47 is preferably formed separately from its holder sleeve 48, to permit its ready renewal in case of wear, and to this end is formed upon an arcuate block 51, Figs. 2, 15 and 16, with rounded edges 52, and adapted to be driven into a suitably formed notch in the holder sleeve 48. The top of said block 51 may be provided with a notch 53 to enable the ready insertion of a punch or other tool for removing said block from its holder 48.

The stop pin 47, backed by its spring 50, therefore travels over the irregular surface of the stop ring 44 during the oscillation of the valve tube 31, the several effective positions of said valve tube being indicated to the operator by the amount of resistance offered to the turning of the tubing string to which said valve tube is attached by the engagement of said stop pin 47 with the various notches of said stop ring 44. Two of these positions, corresponding with the notches 46^a and 46^f, are located by positive stops formed by the vertical sides of a tongue 54, Fig. 17, formed between said notches 46^a and 46^f, and which prevents the stop pin 47 from traversing this portion of the ring. Thus the movement of the valve tube 31 is restricted to an oscillation through an arc of 300 degrees. The remaining positions of said valve tube are located by impositive or indicative stops formed by the engagement of the pin 47 with the notches 46^b, 46^c, 46^d and 46^e, and these are differentiated from each other by the varying degrees of resistance offered to the turning of the tubing string by the various shapes and depths of said notches. Thus in turning the valve tube to carry the pin 47 from the notch position 46^a to 46^b, a constant but comparatively slight resistance is encountered, due to the inclination of the stop ring between these two notches. In moving away from the position 46^b, an initial strong resistance is felt, due to the relatively steep sides of the notch 46^b, which resistance is greater when moving toward the position 46^c than 46^a. The notch 46^e produces the same effect as 46^b, but the directions are reversed. The notch 46^d produces a relatively slight resistance in both directions. The position 46^c may be easily determined by its relation to the positions 46^d and 46^f, the latter being a positive stop.

The lower end of the mandrel 4 is provided with a fluid director, comprising a sleeve 55, Figs. 1, 2, 7 and 8, which is fitted over said mandrel end and retained thereon by any suitable means, as for example, a set screw 56. An interior shoulder 57 serves to lock the mandrel plug 39 in position. Said sleeve 55 is provided with an annular interior groove 58 near its upper end, which registers with and covers the mandrel ports 43 of the lowermost or fourth group described above. From this groove 58 are led passages 59, Fig. 8, extending downwardly through the wall of the sleeve 55, and adapted to discharge the fluid issuing from the ports 43 in a downward direction.

The operation of the valve tube 31 in the control of the several groups of mandrel ports 40, 41, 42 and 43 can best be understood by reference to the diagrams of Figs. 18 to 23 inclusive, wherein are shown the six effective control positions of said valve tube referred to above. In the upper portion of all of these diagrams are shown projections of the stop ring 44, with the stop pin 47 in its six positions, and below are represented the mandrel 4 and the valve tube 31, indicating the open and closed ports at each such position of the stop pin. It is to be understood that these views are merely diagrams for indicating the effect on said ports of the movement of the valve tube, no attempt having been made to show the actual positions of said ports except in so far as such positions may relate to their proper functions.

In Fig. 18 the stop pin 47 is at the position 46^a, and all ports are closed. In Fig. 19 the stop pin 47 is in the position 46^b, and only the intermediate group of ports 41, between the packers 5 and 6, are open. In Fig. 20 the stop pin 47 is in the position 46^c, and only the lowermost, or fourth group of ports 43 are open, said ports discharging the fluid downwardly through the fluid director, not shown in Fig. 20. In Fig. 21 the stop pin 47 is in the position 46^d, and all ports are again closed. In Fig. 22 the stop pin is in the position 46^e, and only the uppermost group of ports 40, above the upper packer 5, are open. In Fig. 23 the stop pin 47 is in the position 46^f, and all ports except those of the second group, 41, are open, that

is, the ports 40 above the upper packer 5, and the ports 42 and 43, below the lower packer 6, are open.

In the operation of my improved perforation cleaner, the device is secured to the bottom of the tubing string and lowered into the well in the usual manner, the valve tube 31 being in the position shown in Fig. 23, to permit the fluid in the well to pass freely through the ports 43 and 42, the valve tube 31 and the ports 40, and thereby to prevent interference with the downward movement of the device. When the perforated section of the casing 1 (shown only in Fig. 1) is reached, the valve tube is turned by means of the tubing string 3, to the position shown in Fig. 18, in which all ports are closed. At this position the positive stop 54 prevents clockwise movement of the valve tube, so that if necessary, the screw joints of the tubing string may be tightened by turning said tubing string in a clockwise direction. Fluid under pressure, from any suitable source not shown in the drawings, is now supplied to the tubing string and valve tube, and when such pressure builds up to the desired point as evidenced, for example, by a pressure gauge (not shown) connected with the tubing string or supply conduit, the tubing string is turned in a counter-clockwise direction, until the first impositive stop is reached, and the pressure drops. The valve tube is now in the position shown in Fig. 19, the fluid being forcibly discharged through the ports 41 between the packers 5 and 6, and consequently being forced out through the perforations of the casing situated between said packers. This clears said perforations and dislodges and loosens any caked formation that may adhere to the outside of the casing, the fluid passing up outside said casing and returning into it through the perforations above the upper packer 5. By shifting the position of the cleaner and repeating this process in each new position, the entire perforated section of the casing can be cleaned.

If it is desired to clean the bottom of the well, as for example to loosen and remove caked formation such as the mud left in a new well from rotary drilling, the valve tube is first turned to the position shown in Fig. 21, in which all ports are closed. This position can be easily determined, not only by the equal and constant resistance encountered when turning the tubing string in either direction, but also by the fact that the pressure of the fluid therein rapidly builds up, all discharge ports being closed. A movement of 60 degrees in a clockwise direction, or until the first indicative stop is reached, brings the valve tube to the position of Fig. 20, opening only the lowermost group of ports 43, and discharging the fluid downwardly through the fluid director shown in Figs. 1 and 2, thereby washing out the bottom of the well. A similar movement in the opposite direction from the position of Fig. 21 opens only the uppermost group of ports 40, as in Fig. 22, discharging the fluid into the casing above the upper packer 5. This position is useful for loosening any caked formation that may have settled above the cleaner and which might interfere with the pulling of the device from the well. It is also useful for introducing a column of fluid into the casing above the cleaner, to counteract, by its weight or pressure, any gas or other fluid pressure below the cleaner, which might tend to force said cleaner and the tubing string upward and cause damage.

My improved cleaner may be left in a well, attached to the bottom of the tubing string or to the bottom of the well pump, according to whether the well is flowing or pumping, to obviate the necessity of pulling the tubing string every time the well needs cleaning. With the valve tube in the position shown in Fig. 23, the oil can flow into the pump or tubing string through the ports 42 and 43. The pressure is equalized between the casing and the tubing string by the open upper ports 40, but by sealing the casing at the surface in the usual manner, the entire flow can be directed through the tubing string, thus eliminating wear on the casing due to sand carried in suspension in the oil. The device may also be used as a packer at any desired depth in the well, the desired fluid being admitted to the tubing string through either the upper or lower ports as circumstances may demand.

The preferred form of the stop ring 44, as shown in the drawings and described above, enables the operator to determine the various positions of the valve tube 31 with the greatest possible ease and accuracy. The most frequent movement of said valve tube is between the positions of Figs. 18 and 19, and in moving from the former to the latter position, there is a constant and relatively slight resistance to the turning force. The position of Fig. 19 is readily recognized by a sudden increase in this resistance, due to the engagement of the pin 47 with the notch 46[b], while the absence of any pronounced notch at 46[a] prevents the valve tube from jumping ahead due to the resilience of the tubing string, and possibly passing the notch 46[b]. The position of Fig. 18, and also that of Fig. 23, are easily determined by the positive stop 54. The next most frequently employed movements of the valve tube 31 are from the position of Fig. 21 to either that of Fig. 20 or Fig. 22; and in these cases the effects are the same as described above for the movement from the position of Fig. 18 to that of Fig. 19. The inclination of the surface of the stop ring 44

is sufficient to hold the valve tube 31 in the positions of Figs. 18, 21 and 23, although permitting its ready movement away from these positions.

My improved device is readily accessible for cleaning and repair. The valve tube 31 and the entire stop mechanism can be removed by removing the sleeve nut 34—12, which encloses said stop mechanism and also relieves the valve tube from the weight of the device and the pulling strains incident to the friction of the packers 5 and 6 against the well casing 1. The parts most subject to wear, viz, the stop ring 44 and the stop pin 47, are both removable and can be replaced without removing any other parts.

I claim:—

1. A well cleaner comprising a chambered member adapted to be suspended within the well casing and having two spaced fluid discharge ports communicating with its interior, a packer carried by said member between said ports and adapted for closing the space between said member and the casing; means for selectively opening and closing either or both ports; and means for supplying fluid to the interior of said member.

2. A well cleaner comprising a chambered member adapted to be suspended within the well casing and having two spaced fluid discharge ports; a packer carried by said member between said ports and adapted for closing the space between said member and the casing; a movable valve member for selectively opening and closing either or both ports; means for indicating and differentiating between the several port control positions of said valve member; and means for supplying fluid to said chambered member.

3. A cleaner for well casings comprising a chambered member adapted to be suspended within the well casing and having a plurality of spaced fluid discharge ports; spaced packers carried by said member for closing the space between it and the casing, said packers separating said discharge ports into a plurality of groups; means for selectively opening and closing any group of discharge ports; and means for supplying fluid to said chambered member.

4. A cleaner for well casings comprising a chambered member adapted to be suspended within the well casing and having a plurality of spaced fluid discharge ports; spaced packers carried by said member for closing the space between it and the casing, said packers separating said discharge ports into a plurality of groups; a movable valve member for selectively opening and closing any group of discharge ports; means for indicating and differentiating between the several port control positions of said valve member; and means for supplying fluid to said chambered member.

5. A cleaner for well casings comprising a chambered member adapted to be suspended within a well casing and having two fluid discharge ports; a packer carried by said member for closing the space between it and the casing; a valve member adapted to be moved to a plurality of positions for opening and closing either or both of said ports; and means for supplying fluid to said chambered member.

6. A cleaner for well casings comprising a chambered member adapted to be suspended within a well casing and having two fluid discharge ports; a packer carried by said member for closing the space between it and the casing; a valve member adapted to be moved to a plurality of positions to open and close either or both ports; cooperating devices carried by said chambered member and said valve member for indicating the several port control positions of said valve member; and means for supplying fluid to said chambered member.

7. A cleaner for well casings comprising a chambered member adapted to be suspended within a well casing and provided with a plurality of independently controllable fluid discharge ports; means for directing the fluid discharged from one of said ports in a downward direction; a packer carried by said member for closing the space between it and the casing above the last mentioned port; and means for supplying fluid to said chambered member.

8. A cleaner for well casings comprising a chambered member adapted to be suspended within a well casing and provided with a plurality of independently controllable fluid discharge ports; a fluid director removably associated with the lower end of said member for directing the fluid discharged from one of said ports in a downward direction; a packer carried by said member for closing the space between it and the casing; and means for supplying fluid to said chambered member.

9. A cleaner for well casings comprising a chambered member adapted to be suspended within a well casing and provided with a fluid discharge port; a valve associated with said member and adapted for oscillation to control said port; a packer carried by said member for closing the space between it and the well casing; means for supplying fluid to said member; and a movable dog carried by said member for engaging the well casing to prevent said member from turning within said casing.

10. A cleaner for well casings comprising a chambered member adapted to be suspended within a well casing and provided with a fluid discharge port; a valve associated with

said member and adapted for oscillation to control said port; means for supplying fluid to said member; and a pair of dogs carried by said member for engaging the well casing to prevent said member from turning within said casing, said dogs being pivotally mounted for opposite swinging movement in a horizontal plane.

11. A cleaner for well casings comprising a chambered member adapted to be suspended within a well casing and provided with a fluid discharge port; a valve associated with said member and adapted for oscillation to control said port; means for supplying fluid to said member; a dog carried by said member and adapted for outward movement to engage the well casing to prevent said member from turning within said casing; and a spring for pressing said dog into engagement with said casing; and means for limiting the outward movement of said dog.

12. A cleaner for perforated well casings comprising a chambered member adapted to be suspended within the well casing and provided with a fluid discharge port; a valve associated with said member and adapted for oscillation to control said port; means for supplying fluid to said member; a movable dog carried by said member and adapted to engage the perforations of the casing to prevent said member from turning therewithin, the effective end of said dog being rounded in a vertical plane to cause it to disengage the perforations upon vertical movement of the member; means for resiliently pressing said dog outwardly into engagement with the perforations of said casing; and means for limiting the outward movement of said dog.

13. A cleaner for well casings comprising a hollow mandrel adapted to be suspended within the well casing and provided with a plurality of fluid discharge ports; means for supplying fluid to said mandrel; a movable valve member for selectively controlling said ports; positive stops adapted to be engaged by said valve member at the opposite limits of its movement; and an impositive stop adapted to be engaged by said valve member for indicating a port control position thereof between said positive stops.

14. A cleaner for well casings comprising a hollow mandrel adapted to be suspended within the well casing and provided with a plurality of fluid discharge ports; means for supplying fluid to said mandrel; a movable valve member for selectively controlling said ports; positive stops carried by said mandrel for limiting the movement of said valve member; an impositive stop carried by said mandrel for indicating a port control position of said valve member between said positive stops; and means carried by said valve member for engaging said positive and impositive stops.

15. A cleaner for well casings comprising a hollow mandrel adapted to be suspended within the well casing and provided with a plurality of fluid discharge ports; means for supplying fluid to said mandrel; a movable valve member for selectively controlling said ports; a member carried by said mandrel and provided with positive and impositive stops; and means carried by said valve member for engaging the stops of said mandrel member to indicate the several port control positions of said valve member.

16. A cleaner for well casings comprising a hollow mandrel adapted to be suspended within the well casing and provided with a plurality of fluid discharge ports; means for supplying fluid to said mandrel; a movable valve member for selectively controlling said ports; a member carried by said mandrel and provided with a notched surface; and means carried by said valve member for engaging the notches of said mandrel member to indicate the several port control positions of said valve member.

17. A cleaner for well casings comprising a hollow mandrel adapted to be suspended within the well casing and provided with a plurality of fluid discharge ports; means for supplying fluid to said mandrel; a movable valve member for selectively controlling said ports, a member carried by said mandrel and provided with spaced projections and a notch therebetween; and means carried by said valve member for engaging said projections to limit its movement and for engaging said notch to indicate a port control position of said valve member between such limits.

18. A cleaner for well casings comprising a hollow mandrel adapted to be suspended within the well casing and provided with a plurality of fluid discharge ports; a hollow valve member adapted for oscillation within said mandrel to selectively control said ports; means for supplying fluid to said valve member; a stop ring carried by said mandrel and provided with an irregular surface; and a stop pin carried by said valve member and adapted to engage the irregularities of said ring to indicate the several port control positions of said valve member.

19. A cleaner for well casings comprising a hollow mandrel adapted to be suspended within the well casing and provided with a plurality of fluid discharge ports; a hollow valve member adapted for oscillation within said mandrel to selectively control said ports; means for supplying fluid to said valve member; a stop ring carried by said mandrel and provided with an irregular surface; a lug projecting from said surface;

and a stop pin carried by said valve member and adapted to engage said lug to limit the oscillation of said valve member and to engage the irregularities of said ring to indicate the port control positions of said valve member between such limits.

20. A cleaner for well casings comprising a hollow mandrel adapted to be suspended within the well casing and provided with a plurality of fluid discharge ports; a hollow valve member adapted for oscillation within said mandrel to selectively control said ports; means for supplying fluid to said valve member; a ring carried by said mandrel and provided with an irregular surface; a second ring slidably mounted on said valve member for movement toward and away from the first ring; a stop pin carried by the second ring and adapted to travel over and engage the irregularities of the first ring to indicate the several port control positions of said valve member; and means for resiliently holding said stop pin in engagement with the irregular surface of the first ring.

21. In a device for the described purpose, a hollow mandrel provided with fluid discharge ports; a tubular valve member mounted for oscillation within said mandrel to control said ports, said valve member being adapted for connection with the tubing string of the well and having an exterior shoulder; and a sleeve associated with the mandrel and provided with an interior shoulder adapted to engage the exterior shoulder of said valve member to support the mandrel therefrom.

22. In a device of the described purpose, a hollow mandrel provided with fluid discharge ports; a tubular valve member mounted for oscillation within said mandrel to control said ports, said valve member being adapted for connection with the tubing string of the well and having an exterior shoulder; mechanism for indicating the port control positions of said valve member; a removable sleeve associated with said mandrel and inclosing said mechanism; and an interior shoulder formed upon said sleeve and adapted to engage the exterior shoulder of said valve member to support the mandrel therefrom.

23. In a device for the described purpose, a hollow mandrel provided with fluid discharge ports; a packer carried exteriorly upon said mandrel and adapted to close the space between said mandrel and the well casing; a tubular valve member mounted for oscillation within said mandrel to control said ports, said valve member being adapted for connection with the tubing string of the well and having an exterior shoulder; a nut for retaining said packer in position upon said mandrel; and a sleeve carried by said nut and provided with an interior shoulder adapted to engage the exterior shoulder of said valve member to support the mandrel therefrom.

24. In a device for the described purpose, a hollow mandrel provided with fluid discharge ports; a packer carried exteriorly upon said mandrel and adapted to close the space between said mandrel and the well casing; a tubular valve member mounted for oscillation within said mandrel to control said ports, said valve member being adapted for connection with the tubing string of the well and having an exterior shoulder; a nut for retaining said packer in position upon said mandrel; and a sleeve carried by said nut and provided with an interior shoulder adated to engage the exterior shoulder of said valve member to support the mandrel therefrom, said sleeve being provided with an exterior substantially horizontal groove adapted for engagement by a fishing tool.

25. A cleaner for well casings comprising a hollow mandrel having four fluid discharge ports disposed throughout its length; upper and lower spaced packers carried by said mandrel for closing the space between it and the casing, there being one port above the upper packer, one port between the two packers, and two ports below the lower packer; a valve member carried by said mandrel for selectively controlling said ports; and means for directing the discharge from the lowermost port in a downward direction.

In testimony whereof I have signed my name to this specification.

ALONZO LEWIS HALLIDAY.

Nov. 4, 1924. 1,514,585

C. R. EDWARDS

TESTING DEVICE FOR OIL WELLS

Filed Jan. 17 1921

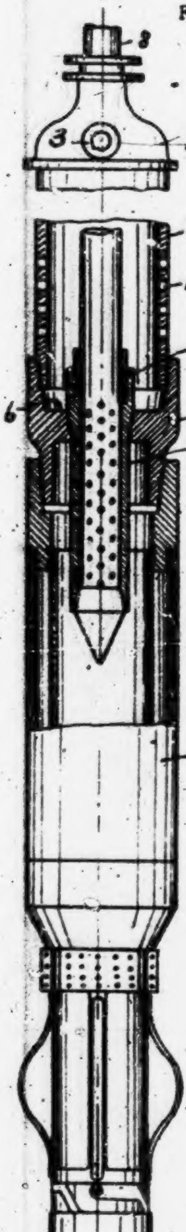


Fig. 1.

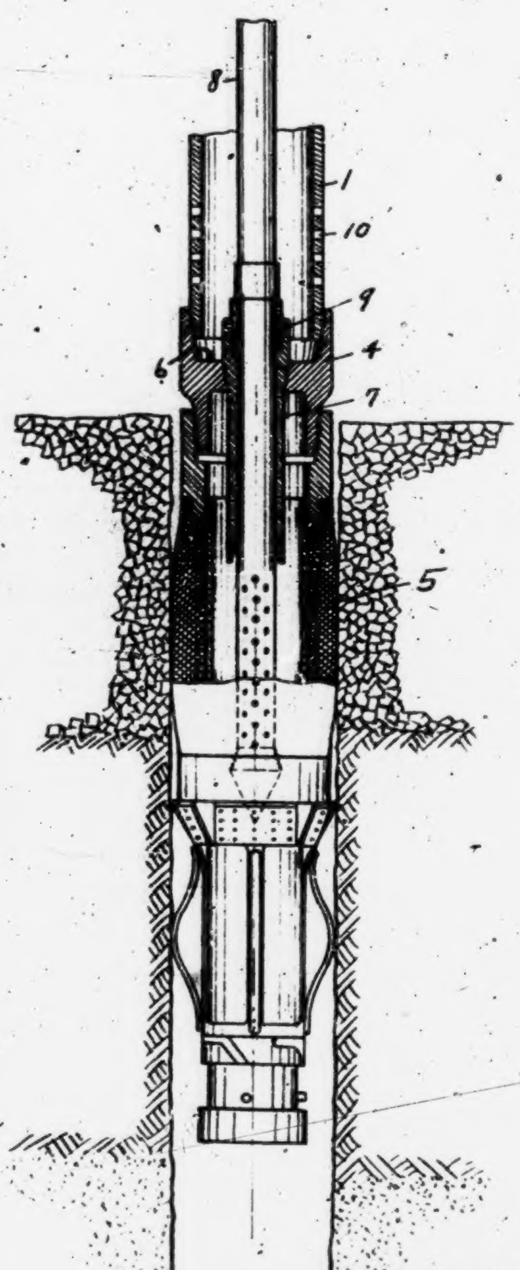


Fig. 2

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By
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Patented Nov. 4, 1924. **1,514,585**

UNITED STATES PATENT OFFICE.

CHARLES R. EDWARDS, OF HOUSTON, TEXAS.

TESTING DEVICE FOR OIL WELLS.

Application filed January 17, 1921. Serial No. 437,972.

To all whom it may concern:

Be it known that I, CHARLES R. EDWARDS, a citizen of the United States, residing at Houston, in the county of Harris and State of Texas, have invented certain new and useful Improvements in a Testing Device for Oil Wells, of which the following is a specification.

This invention relates to new and useful improvements in a testing device for oil wells.

One object of the invention is to provide a device of the character described which is specially adapted for testing the strata, being pierced, in drilling oil, gas or other wells, for the purpose of determining the presence or absence of oil, gas or other fluids.

With the above and other objects in view the invention has particular relation to certain novel features of construction, operation and arrangement of parts, an example of which is given in this specification and illustrated in the accompanying drawings, wherein:—

Figure 1 is a side elevation of the device, and

Figure 2 is a side elevation, partially in section, showing the well packer set.

Referring now more particularly to the drawings, the numeral 1 refers to a pipe, usually the ordinary drill stem which is let down into the bore as drilling progresses. The upper end of the pipe carries the casing head 2, having the hose connection 3, through which water or slush is forced into the interior of the pipe by means of the ordinary slush pump commonly used for the purpose.

Threaded onto the lower end of the pipe there is a nipple 4 to which the packer 5 is attached. This packer is provided to separate any stratum that may be encountered from any other stratum to be tested. This packer is of the usual construction, well known to those familiar with the art of drilling wells.

The nipple 4 has a seat 6 and depending therefrom there is a surrounding sleeve 7 whose lower end has internal threads.

A stem 8 is fitted through the casing head 2 and the sleeve 7 fits over the lower end of this stem and is threaded thereon. The lower end of the stem is closed and preferably pointed and the section thereof within the sleeve 7 is perforated. The upper end of the sleeve is formed with a stuffing box 9 through which the stem fits and which forms a water tight joint therewith.

In drilling, water, laden with mud, is forced under pressure of the pump, down into the bore to carry away the cuttings from the drill. This operation makes it difficult to test the strata for oil with the ordinary drilling equipment. With my apparatus, when it is desired to make a test, the drill pipe with the nipple 4 and the perforated lower end attached to the packer is lowered to near the bottom of the well; then the test stem 8, together with the sleeve 7, is lowered to a point above the seat 6 and water is then pumped down through the casing head 2 to wash out the bottom of the well by forcing water down the inside of the pipe 1 past the test stem 8 and the seat 6, to below the packer, thoroughly washing the stratum to be tested. The packer is then raised, tripped and set. The test stem is seated on the seat 6 and the slush pump started pumping in mud down the pipe 1, out through its perforated lower end and up so as to maintain the wall. After a time so as to let the water settle away and oil, gas or other fluid to accumulate, the test stem is screwed to the right, thus unscrewing it from the sleeve 7 and the test stem 8 is lowered. If there be any pressure of oil, gas or other fluid it will now rush through the perforated section of the stem 8, and up the stem and if there be sufficient pressure of the oil, gas or other fluid from the stratum below the packer, it will push a stream of the same from the top of said stem. By placing an ordinary working barrel at any suitable point in the test stem 8, if the pressure of the oil, or other fluid should not be great, the pump in the working barrel can be started and the fluid forced out through the stem 8, thus completely testing the stratum under investigation, both as to quality and quantity of flow of the fluid, and if oil or gas under enormous pressure is encountered, the superpressure may be relieved before attempting to set regular casing.

To withdraw the apparatus the packer is first released before stopping the slush pump and the test stem is then withdrawn before withdrawing the drill pipe and packer.

What I claim is:—

1. The combination with a packer adapt-

ed to be set in a well bore, of a stem provided to be inserted through said packer and adapted to communicate with the bore beneath said packer and permit fluid to be forced from the stratum, below said packer.

2. The combination with a packer adapted to be set in a well bore, of a tubular stem fitted through said packer, and normally blocking the same against the passage of fluid therethrough, the lower end of the stem being provided with an inlet through which the stem communicates with the bore beneath the packer when the stem is lowered through said packer.

3. The combination with a casing whose lower end is perforated, of a packer attached to the lower end thereof, and adapted to be set in a well bore, a stem fitted through the packer and at all times closing the packer against the flow of fluid from the casing downwardly therethrough, said stem, while in one position, excluding the flow of fluid therethrough from the bore beneath the packing and while in another position permitting fluid to flow from beneath the packer upwardly therethrough.

4. The combination with a casing whose lower end is perforated, of a packer attached to the lower end thereof, a sleeve within the packer, a stem within the casing whose lower end is fitted through the sleeve, the lower end of the stem being closed and the section thereof within the packer being perforated.

5. The combination with a packer adapted to be set in a well bore and having an internal fluid passageway, of a stem adapted to be inserted into said passageway to block the same, said stem being adapted to be lowered through the packer, and when in lowered position communicating with the bore beneath the packer and adapted to permit the forcing of fluid through said stem from the strata, below said packer.

6. The combination with a packer adapted to be set in a well bore, of a tubular stem fitted through said packer and normally blocking the same against the passage of fluid therethrough, the lower end of said stem being provided with an inlet which is closed when the stem is in said blocking position, said stem being capable of being lowered beneath the packer and when in lowered position to communicate through said inlet with the bore beneath the packer.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES R. EDWARDS.

Witnesses:
R. M. SMITH,
WM. A. CATHEY.

DISCLAIMER

1,514,585.—*Charles R. Edwards*, Houston, Tex. TESTING DEVICE FOR OIL WELLS. Patent dated November 4, 1924. Disclaimer filed July 3, 1930, by the patentee.

Hereby enters this disclaimer to so much of claim 1 of said patent as is in excess of the following:

In an apparatus for testing the productivity of a stratum exposed in a well while containing drilling fluid which might substantially prevent a flow from said stratum, the combination with a packer adapted to be set in a well bore, of a stem provided to be inserted through said packer and adapted to communicate with the bore beneath said packer to relieve pressure of said fluid against said exposed stratum and permit fluid to be forced from the stratum, below said packer.

Your petitioner also hereby enters this disclaimer to so much of claim 5 of said patent as is in excess of the following:

In an apparatus for testing the productivity of a stratum exposed in a well while containing drilling fluid which might substantially prevent a flow from said stratum, the combination with a packer adapted to be set in a well bore and having an internal fluid passageway, of a stem adapted to be inserted into said passageway to block the same, said stem being adapted to be lowered through the packer, and when in lowered position communicating with the bore beneath the packer and adapted to permit the forcing of fluid through said stem from the strata, below said packer.

Your petitioner also hereby enters this disclaimer to so much of claim 6 of said patent as is in excess of the following:

In an apparatus for testing the productivity of a stratum exposed in a well while containing drilling fluid which might substantially prevent a flow from said stratum, the combination with a packer adapted to be set in a well bore, of a tubular stem fitted through said packer and normally blocking the same against the passage of fluid therethrough, the lower end of said stem being provided with an inlet which is closed when the stem is in said blocking position, said stem being capable of being lowered beneath the packer and when in lowered position to communicate through said inlet with the bore beneath the packer.

[*Official Gazette July 22, 1930*]

DISCLAIMER

1,514,585.—*Charles R. Edwards*, Houston, Tex. TESTING DEVICE FOR OIL WELLS. Patent dated November 4, 1924. Disclaimer filed March 8, 1932, by the patentee.

Hereby enters this disclaimer as follows:

He, said patentee, disclaims any interpretation of any of the claims, 1 to 6, inclusive, in the patent which does not restrict said claims to a device that is capable of closing the test stem to the entrance of fluid from the bore beneath the packer by motion of the stem while the packer is set.

[*Official Gazette April 5, 1932.*]

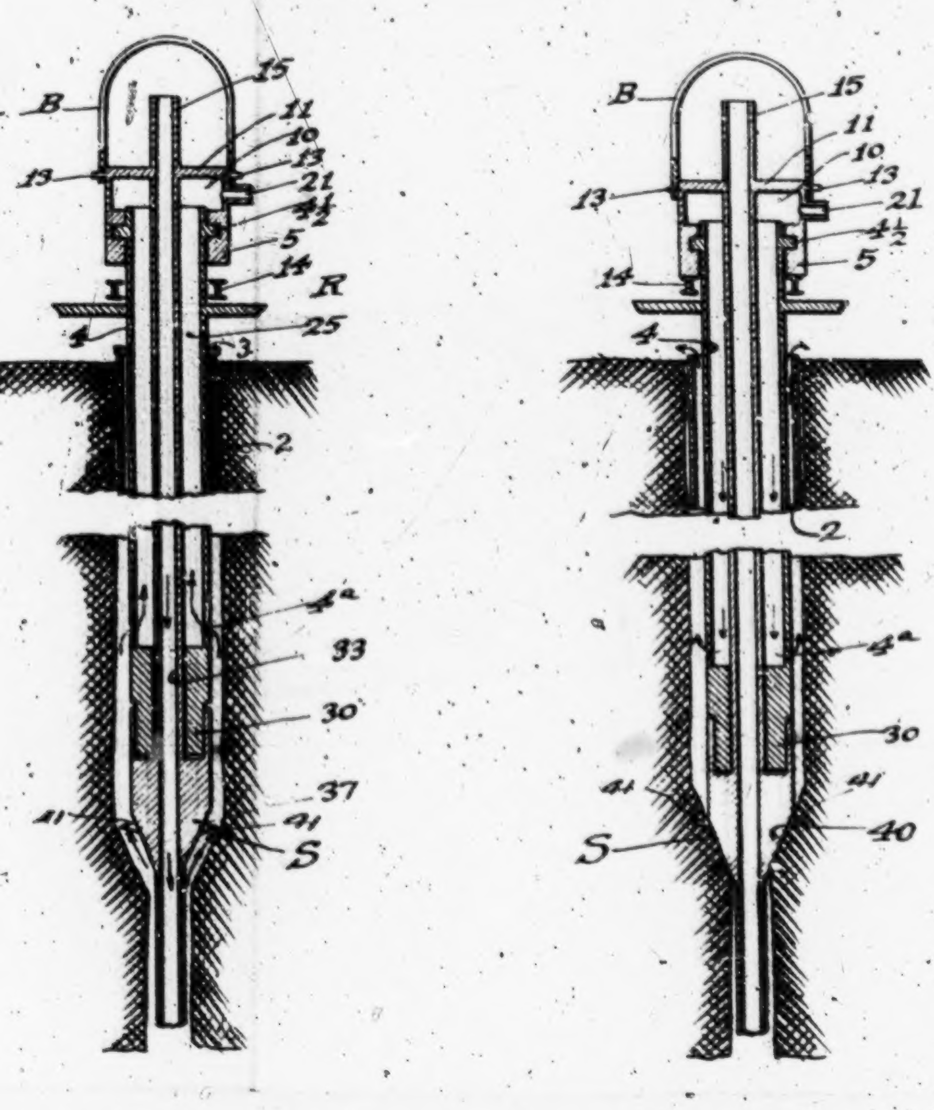
a. 6, 1925. 1,522,197

G. A. MACREADY

METHOD FOR MAKING PRODUCTION TESTS IN WELL DRILLING

Original Filed July 25, 1922

Fig. 1. Fig. 2.



Inventor:
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Witness:
W. Hall

Patented Jan. 6, 1925. **1,522,197**

UNITED STATES PATENT OFFICE.

GEORGE A. MACREADY, OF LOS ANGELES, CALIFORNIA.

METHOD FOR MAKING PRODUCTION TESTS IN WELL DRILLING.

Original application filed July 25, 1922, Serial No. 577,433. Divided and this application filed August 2, 1923. Serial No. 655,205.

REISSUED

To all whom it may concern:

Be it known that I, GEORGE A. MACREADY, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in a Method for Making Production Tests in Well Drilling, of which the following is a specification.

This is a division of my application Serial No. 577,433, filed July 25, 1922, for apparatus and method for making production tests in deep well drilling.

This invention relates to an improved method for facilitating the making of production tests of the lower portions of deep wells so as to determine the proper point at which the well is to be sealed off so as to cut off water from above the oil bearing strata.

It is an object of the present invention to provide a method for shutting off water and for maintaining a circulation in a deep well preparatory to and while making a production test so as to insure the recovery of the apparatus utilized by keeping it from being frozen in the well or jammed. A further object is to maintain a circulation in a well and apparatus and at the same time rotate a portion of the apparatus during the production test. Another object is to provide for the washing of the well by introducing clean water during the lowering of the testing apparatus utilized to a previously formed packer seat.

An object is to provide for the removal of the washings from the well during the lowering of the packer by passing the washings between inner and outer pipes of the apparatus to prevent scouring of the wall of the well above the packer and effect rotation of the outer pipe while the washing circulation is maintained. It is, therefore, broadly, an object of the invention to provide a washing circulation in which the discharge water from the well passes up in through the apparatus and not directly along the well wall.

Another object is to provide a method for facilitating production tests and for aiding in determining the permanent sealing zone and for maintaining circulation, and to provide for maintaining, by rotation, a free circulating pipe whereby the packer may be recovered after performance of function.

Other objects and advantages will be made manifest in the following specification of the preferred method comprising the present invention as effected by apparatus illustrated in the accompanying drawings, in which:

Figure 1 is a diagrammatic, vertical, longitudinal section of the apparatus in the step of being lowered to a temporary sealing position.

Fig. 2 is a longitudinal, vertical section of the apparatus in its effective sealing and circulation maintaining position.

The present method may be practiced and effected by an apparatus illustrated in the accompanying drawings including a string of pipes and a packing section at the foot thereof and a swivel case at the head thereof, the pipes of which are capable of being bodily lowered, excepting at the swivel top mechanism, into the well casing 2, of suitable diameter, and at the top of which is a stuffing box 3, Figure 1, surrounding an outer pipe 4 of such diameter as to form a suitably sized cylindrical passageway within the casing 2.

The swivel case 5 is provided with an open upper end and forms a suitable chamber 10 which is closed as by a retaining cap 11 mounted on the rim of case 5. This latter is shown as provided with diametrically opposite trunnions 13 to be engaged by any suitable elevating and suspending means for such period of time as may be necessary in lowering the apparatus into the well hole after which the case 5 is lowered to a suitable support, as for instance a set of supporting beams 14, Figure 2. This enables the throwing of the elevating mechanism of the string out of connection and facilitates the application of other appurtenances, as for instance to connect a small swivel of circulating pipes to the top of an inner pipe 15. This also provides for the step of bailing the well through the inner pipe 15 when the swivel case 5 is stationary on a permanent support.

A form of mechanical construction providing for the rotation of the top pipe section 4 includes an annular shoulder 4½ provided on this top section.

Circulation into and from the swivel case chamber 10 is provided by any suitable connection as a lateral coupling 21 which may be connected to the circulation pumps or otherwise as may be necessary so that water

can be forced down in the outer pipe 4 or can flow up through the outer pipe 4.

The head pipe section 15 is of sufficiently small diameter to provide an ample passageway 25 within the pipe section 4.

The inner string of pipe 15 includes a foot section of hollow spindle 33. The hollow spindle passes down and rotatably fits in the bearing sleeve 30. The packer body 37 has an effective packing exterior lower portion which is preferably tapored so as to form a good seal upon a previously cut seat prepared therefor in the well hole.

From the above it will be seen that when the elevating and suspending bail device, B, Fig. 1, is attached to the swivel case trunnion 13, the whole string of inner and outer pipes 15 and 4 are carried by the casing swivel and the outer pipe is adapted to be rotated by the usual rotary table R of a rotary drilling apparatus. While the string of packer elements are being lowered into the well, rotation can be maintained by the rotary table R of the outer pipe 4, while the inner pipe and the packer attached to the packing spindle 33 thereof being connected by a swivel joint at the bottom of the string in the bearing 30 does not rotate. During the lowering of the string, circulation is maintained by a flow of circulation fluid entering the top of the inner pipe 15, thence down to the bottom of the inner pipe where it discharges freely into the well and passes up to the surface thereby preventing the pipe from sticking. Just before seating of the packer, circulation is maintained as by a flow of water entering the top of the inner pipe 15, and thence down to the bottom of the inner pipe where it discharges freely into the well and passes up outside of the lower inner pipe and around the packer 37 as is shown in Fig. 1, and thence up until the water may find access into the outer pipe 4. This access and escape from the well hole is provided by a series of apertures 4^a in the lowermost section of the pipe 4 just above the foot swivel and bearing member 33. The stuffing box 3 being closed, prevents the water from going up outside of pipe 4 thereby avoiding scouring the walls of the hole. The upwardly flowing water passes freely into the space between the inner pipe 15 and the outer pipe 4 and thus does not rise along the well wall and the scouring of the wall is prevented above the packer. The water entering the pipe 4 passes to the top thereof and escapes through the lateral connection 21 as indicated in Fig. 1.

When the packing string has been lowered to the necessary position, the packing facing 40 engages the seat S provided therefor in the well hole and becomes fixed and solidly seated and is held against rotation upon the seat or by the interlocking of the holding prongs 41 engaging in the wall. As soon as the packer has become seated, it will be seen that upflow from below is prevented except through the innermost or central pipe 15. This is open continuously from top to bottom and provides for the bailing of the bottom of the well and for such other steps as may be taken in the production test.

When the packer is seated, mud circulation may be maintained from the pump system by forcing the fluid into port 21 of the swivel case at the head of the well wall when this is seated on its permanent supports 14. The fluid is forced down through the space between the inside pipe 15 and the outside pipe 4 and discharges outwardly through the openings 4^a and passes upwardly along the surface of the well and plasters the wall above the packer. This fluid circulation prevents the pipe sticking or freezing to the walls of the well. The upwardly flowing circulating mud is discharged through the well casing at the head of the well.

It will be seen also that the weight of the columns of pipes upon the seated packer can be readily regulated by the amount of weight of the swivel head and apparatus that is superimposed on the permanent supports 14 upon which the swivel case is lowered after the packer has become seated. The advantage of this is that considerable strain is removed from the packer and also from the string of pipe sections and their joints throughout the string.

This method provides for the constant motion of the outer pipe string 4 while it is being lowered into the hole and after the packer has become firmly seated and provides also for the downward or upward circulation or flow of liquid in the space between the two pipes, and also between the outer pipe and well wall, and all of this with the object of insuring the possibility of recovering the apparatus from the well.

Further embodiments, modifications and variations may be resorted to within the principle of the invention.

What is claimed is:

1. A method for making production tests in drilled wells before permanently sealing the well which consists in lowering a packer into the well to engage a previously formed seat, and maintaining a circulation of clean water down through the packer apparatus and up through the lower portion of the well and into the packer apparatus and to wash mud from well wall below the packer.

2. A method for making production tests in drilled wells before permanently sealing the well which consists in lowering a packer into the well to engage a previously formed seat, maintaining a circulation of clean water down through the packer apparatus and up through the lower portion of the well and into the packer apparatus to wash mud from the well wall below the packer

without scouring the wall of the well above the packer, and constantly moving parts of the packer apparatus while the circulation is being maintained.

3. A method for making production tests in drilled wells before permanently sealing the well which consists in lowering a packer into the well to engage a previously formed seat, and maintaining a circulation of clean water down through the center of the packer apparatus and up through the lower portion of the well and into the packer apparatus to facilitate insertion of the apparatus without scouring the wall of the well above the packer.

4. A method for making production tests in drilled wells before permanently sealing the well which consists in lowering a packer into the well to engage a previously formed seat, and maintaining a circulation of clean water down through one channel of the packer apparatus and up through the lower portion of the well and into channels of the packer apparatus.

5. In a well drilling process, sealing a drilled well by a removable packer apparatus and maintaining a circulation in and out of the apparatus after the packer is placed upon a seat therefor in the well.

6. In a well drilling process, sealing a deep well by a removable packer apparatus, constantly moving elements of the packer while the latter is stationary on its seat to prevent the outer elements from freezing in the well, and maintaining a circulation in the packer apparatus above the packer so as to plaster the wall of the well above the stationary packer.

7. In a well drilling process, inserting a packing and bailing apparatus in a drilled hole and resting a head part of it stationarily upon a previously formed seat, moving a part of the packer apparatus while the packer head is stationary on said seat, maintaining a circulation in the apparatus about the packer, and bailing from below the packer.

8. A method for making production tests in drilled wells before permanently sealing the well which consists in lowering a packer into the well to engage a previously formed seat, maintaining a circulation of clean water down through the packer and up through the lower portion of the well and into the packer to wash mud from the well wall without scouring the wall of the well above the packer, and rotating an outer part of the packer.

9. A method for making production tests in drilled wells before permanently sealing the well which consists in lowering a packer apparatus into the well to engage a previously formed seat, maintaining a circulation of clean water down through the packer apparatus and up through the lower portion of the well and into the packer apparatus, and rotating an outer part independently of the seated part of the packer apparatus.

10. In well drilling process, lowering a removable packer into a well to engage a previously formed seat to seal the well, maintaining circulation above the seated packer and maintaining motion on the means used for lowering the packer above the packer while the packer is stationary on its seat, thereby preventing said means from sticking and facilitating recovery of the apparatus, and drawing fluid from below the packer to the surface.

11. In a well drilling process, sealing a drilled well by a removable packer apparatus and maintaining a circulation in and out of the apparatus after the packer is placed upon a seat therefor in the well, and constantly moving parts of the apparatus to prevent sticking.

In testimony whereof I have signed my name to this specification.

GEORGE A. MACREADY.

Notes.

In drilling an oil well the measures passed through are necessarily divided into three groups or divisions. Each one of these divisions requires a specific treatment at the hands of the driller.

The first division is composed of drift or the loose surface accumulations from the surrounding rocks; the second embraces the immediately underlying series of stratified rocks to the depth at which they contain water; and the third, the remainder of the well, including the oil sands at the bottom. The walls of the third division are generally self-supporting, remaining just as the drill leaves them, and this division, when the well is completed, is the only one where the rocky walls are bare.

The first division, owing to the loose and crumbling material of which it is composed, requires some mechanical device to prevent it from slipping or caving into the hole as it is drilled. Here the "conductor" is used. A "conductor" may be simply a long box, without ends, made by spiking together four planks 2″ thick by 10″ wide—a "wooden conductor;" or it may be "drive pipe," composed of a number of cast-iron cylinders joined together and driven through the deposit; or it may be what is now more generally used, wrought-iron "surface casing," put in in a somewhat similar manner.

The "wooden conductor" can only be economically used where the surface deposit is of inconsiderable depth, as a pit must be sunk to the rock before it can be put in place. After the rock has been laid bare by the pick and shovel, the "conductor" is securely set between it and the derrick floor, the drill is let down to the rock through the conductor and the work of boring commences.

Where it is suspected that the floor of the drift lies too deep to be reached by digging, cast-iron "drive pipe" is used. This pipe is cast in sections about 9′ long. A space of 4″ at each end is carefully turned in a lathe to a certain gauge, and the end is cut smoothly at right angles to the axis of the pipe, so that the joints will stand perpendicularly one upon the other. A joint of pipe is placed on end in the centre of the derrick between two "guides," which have been temporarily erected for the purpose of driving it. A heavy "mall" working between these

guides is raised and dropped upon the pipe, slowly forcing it into the ground, precisely as piles are driven for docks, bridges, &c. When the top of a joint has been driven to the level of the derrick floor a band of wrought iron, made to fit the turned ends of the pipe, and heated red-hot, is quickly slipped upon the end of the driven pipe and another joint at once set up. The contraction of this band in cooling holds the two joints firmly together, and the driving process then goes on. In this way joint after joint is added and driven until solid rock is reached. As many as 23 joints have been used in a well. Great care is required when so long a "string of pipe" is driven to keep it straight and perpendicular, a broken band, or a large boulder encountered may cause the pipe to so far deviate from the perpendicular as to necessitate the abandonment of the well. To avoid this the pipe should be frequently cleaned out by the drill while being driven.

The more common method now employed in driving the well shafts through these thick accumulations of loose materials is to use heavy wrought-iron casing, made expressly for the purpose and armed with a hardened collar or "shoe" at the bottom. This casing is made in joints about 20′ in length, which screw together in wrought-iron "thimbles," the same as do ordinary gas pipes. The tube being thin and light, as compared with cast-iron drive pipe, cannot be so forcibly driven, but is worked down carefully by drilling a hole the full size of its inside diameter, and always keeping this hole open some feet in advance of the bottom of the pipe. In the old filled up valley of the Tunanguant, at Tarport, M'Kean Co., Pa., from 200′ to 300′ of this casing is required in each well.

Wells are spoken of indiscriminately as "small holes" or "wet holes" on the one hand, and as "cased holes" or "dry holes" on the other. A "small hole" must necessarily be a "wet" one, for there is no room to case off the water while drilling; and a "cased hole" must necessarily be a "dry" one, if the casing accomplishes the purpose for which it is used.

If now a well is to be drilled "wet," that is, if no effort is to be made to shut off the water which comes into it from the second division mentioned above, to keep it from following the drill down to the oil rocks, then this "conductor" of which we

have been speaking, whether of wood, cast-iron or casing, needs only to be 6″ in diameter, inside measurement. But if the well is to be drilled "dry" an 8″ conductor must be used, as will be seen further on.

In the first case, (for a wet well,) after the conductor is in place, a plain $5\frac{1}{2}$″ hole is drilled all the way to the oil rocks; the water, meantime, nearly filling the well, or perhaps overflowing at the top of the conductor.

In the latter case, (for a dry hole,) an 8″ hole is to be drilled from the bottom of the conductor to a point below the water veins. When this is done, a $5\frac{5}{8}$″ casing (inside diameter) is inserted, with a device on the bottom so arranged that it will form a water tight joint between the casing and wall of the well. A $5\frac{1}{2}$″ hole is then continued down to the oil rocks from the inside of this last "string of casing." If the casing has been inserted to the proper depth and no water is encountered below it, the sand pump will soon exhaust the water in the process of drilling, and the well be perfectly dry. But if lower veins of water are struck, the casing must be drawn, the hole reamed out to a greater depth, and the casing continued down below them. After the water is exhausted, a few pails full are poured in, as circumstances demand, to moisten the drillings and furnish fluid for the sand-pump.

Comparing now the two wells when completed and ready for the pump, we find them both of the same size, $5\frac{1}{2}$″ in diameter. One has simply a conductor through the upper division, all the stratified rocks being bare, is full of water, and has probably shown but very little indication of oil. The other has a conductor through the upper division, casing inside of this to the bottom of the middle division, and is dry—or at least was dry until the striking of the oil sand, when it immediately filled up several hundred feet with oil, or perhaps flowed.

The "dry" well is ready at once for the introduction of the pump tube; the "wet" one must be cased before it is tubed. The casing used for this purpose ("small casing,") is of $3\frac{1}{4}$″ inside diameter. A "water packer" or "seed bag" is attached to its lower end, which effectually closes the annular space between the outside of the casing and wall of the well. This "small casing," of course, must extend down to the bottom of

ond division, the same as the large casing does in the ell, for it has precisely the same duty to perform, the ..g off of the water in the upper rocks from the well shaft.

The well is now tubed with the ordinary 2″ "tubing," having a "working barrel" or pump chamber at the bottom, which is placed at or near the point where the oil enters.

Inside of the "tubing" are inserted the "sucker rods," which are connected in the derrick to the "walking beam," and operate the pump valves below.

Upon starting the pump the "water packer" prevents any of the fluid outside of the casing from entering the well, and the water inside of the casing and in the uncased portion of the well is soon pumped out and the well is said to be "exhausted." As the well exhausts, the oil, which has been held back in the rock by the pressure of the heavy column of water above it, gradually forces its way into the well and is raised by the pump to the surface, unless it has a sufficient force of gas to flow of its own accord afterwards.

Further and detailed information on these and other points will be published in the Report of Progress, I.I.I., 1877.

CHAPTER V.

PITHOLE.

Records of Wells at Pithole City and vicinity, Cornplanter township, Venango County, drilled on the M'Kinney, Morey, Holmden, Rooker, Ball, Hyner, Babbitt, Reynolds and Dawson Farms.

These Pithole wells were drilled in 1865 and 1866, before the introduction of "dry casing" and before the ordinary 3¼ inch casing had come into general use. The larger part of them, therefore, were tested in the primitive way with a common flax-seed bag on the tubing.

Authority, (unless otherwise stated,) Mr. Samuel Minor, of Titusville, to whose large experience in oil operations and wise forethought in preserving every record obtained, in a book kept especially for the purpose, we are indebted for much valuable information in connection with these old wells.

GROUP 1.

M'KINNEY FARM.

(15 Wells.)

860. *Well No. 1, Lease No. 10.*

Well mouth above ocean in feet				
? (Interval unknown)	120	to	120	=
1st SS. (First Sandstone) estimated	12	"	132	=
?	225	"	357	=
2d SS., estimated	22	"	379	=
?	65	"	444	=
3d SS., estimated	18	"	462	=
?	137	"	599	=
4th SS	21	"	620	=

401

Wet hole. Seed bag at 372′ not effectual, but at 490′ effectual. No salt water.

861. *Well No. 2. Lease No. 10.*

December, 1865.

Authority, H. M. Haskell.

Well mouth above ocean in feet					1336
? (Interval unknown)	115	to	115	=	1221
1st SS. (First Sandstone)	12	"	127	=	1209
?	235	"	362	=	974
2d SS	22	"	384	=	952
?	56	"	440	=	896
3d SS	17	"	457	=	879
?	38	"	495	=	841
Stray	8	"	503	=	833
?	102	"	605	=	731
4th SS	20	"	635	=	701

Wet hole. Seed-bagged on tubing at 500′. Production, 28 barrels per day.

In July, 1866, the well was cased at 500′, with 3¼″ casing, and the production immediately increased to 70 barrels per day. In March of the following year it was still doing about 60 barrels.

862. *Well No. 17.*

Well mouth above ocean in feet					
Conductor	8 feet.				
Slate	92	to	100	=	
1st SS.	5	"	105	=	
?	260	"	365	=	
2d SS	12	"	377	=	
?	88	"	465	=	
3d SS., 18 inch crevice	12	"	477	=	
?	125	"	602	=	
4th SS, 8 inch crevice	17	"	619	=	
? pocket,	1	"	620	=	

Wet hole. Seed bags at 365′ and 465′. This well was located on east bank of Pithole creek.

863. *Well No. 29 (Old No. 6).*

Well mouth above ocean in feet					
?	375	to	375	=	
2d SS	26	"	401	=	
?	55	"	456	=	
3d SS., A.	21	"	477	=	

Slate	74	to	800	=
Red rock	15	"	815	=
Slate	79	"	894	=
Red rock	20	"	914	=

Wet hole. Unproductive. Water at 13′, 37′, 5[illegible], 95′, 400′ and 738′. Gas at 248′, 270′, 485′, 630′ and 800′.

1041. *Experimental Well, No.* 1.

Cotter farm, on Brokenstraw creek, Pittsfield township, Warren county, 2 miles above Garland. Authority, C. W. Hare, the present owner.

Well mouth above ocean in feet				
Conductor	13	to	13	=
Slate, blue and gritty	6	"	19	=
SS. (Sandstone) grey	2	"	21	=
Slate	11	"	32	=
SS	2	"	34	=
Slate	49	"	83	=
Shale	30	"	113	=
SS., white and flinty	40	"	153	=
Soapstone	54	"	207	=
Slate, gritty and mixed with quartz	18	"	225	=
Red rock	4	"	229	=
Soapstone	5	"	234	=
Slate, with thin white sand shell	16	"	250	=
Soapstone	43	"	293	=
SS., quartz, thick oil and gas	2	"	295	=
Soapstone oil show	35	"	330	=
SS., (crevice)	2	"	332	=
Soapstone, show of oil and soot	20	"	352	=
Slate	10	"	362	=
Soapstone	14	"	376	=
SS	4	"	380	=
? (Interval unknown)	240	"	620	=
Slate, hard	10	"	630	=
SS	5	"	635	=
Soapstone and slate	97	"	732	=
3d SS	7	"	739	=
Slate, soft and soapy	8	"	747	=

Wet hole. Seed bagged at 116′. Tested at 634′, and again at 747′. Unproductive.

Another well was put down on this farm of which no log can be found.

[This other well referred to was on an island in Brokenstraw creek, and I was informed by Mr. John Jones, lessee of the farm, who appeared to be perfectly familiar with the history

of these wells, that about 200′ of drive pipe had to be driven in the island well to reach the bottom of the drift; that the well was drilled 1,000′ and then tested for two weeks. Failing to produce oil it was sunk 500′ deeper, and again tested with like results. On the last test, which was continued for 3 weeks, it showed no oil or gas but pumped about 75 barrels per day of very salt water. 1,500 feet at that time (about 1865) was a very unusual depth for a well, and it is a great pity that the record is lost. It would have given us some idea of the measures for at least 1,100′ below the horizon of the Venango oil group.—J. F. C.]

1042. "*Porkey Run*" *Well.*

1877.

S. Q. Brown farm; tract 87, Oil Creek township, Crawford county, 3 miles north-east of Titusville. Authority, Wm. F. Newton, lessee.

Well mouth above ocean in feet					
Conductor (wood, 25; sheet iron, 39;)	39	to	39	=	
SS. (Sandstone) yellow	20	"	59	=	
Slate, soft	15	"	74	=	
Blue mud, running in well	15	"	89	=	
Slate	101	"	190	=	
1st SS	42	"	232	=	
Slate, soft soapstone and red rock	184	"	416	=	
2d SS., grey	22	"	438	=	
Slate	20	"	458	=	
Sand shells, hard and grey, no pebble	12	"	470	=	
Slate, soft, no red	80	"	550	=	

The casing had to be put in at 103′ to shut off the mud which was freely running into the well, making it almost impossible to drill. Water came in below this point, and consequently the well was drilled wet. There was a red band about 6′ thick in the lower part of the slate immediately above the 1st SS.

Unproductive.

special specimens, yet *the records are intended to indicate the quality of the strata as shown by all the facts obtained at the wells while they were being drilled*, and consequently they may not always give a *precise description* of the particular specimen referred to.

§ 407. *Records written out from an examination of specimens* have been productive of an abundance of error, when unaccompanied by explanatory notes. Specimens do not always correctly represent the character of the rocks drilled through. A great deal depends upon the manner of washing and drying them. A series of sand-shells and argillaceous shale may be so ground up together by the drill that a thorough washing will leave nothing but sand. Frequently all traces of the soft red shales are thus entirely lost.

A small percentage of pebbles in an argillaceous or slaty matrix, may be washed and manipulated so as to present a very good pebble specimen.

A muddy sand may be washed so that it can scarcely be distinguished from a pure sand.

The natural color of a specimen may be entirely changed by oxydation of the small particles of metal worn from the tools, especially if the hole contains salt water and the material is not quickly dried.

Careless sand-pumping while in a hard sand may leave the bottom of the hole full of drillings to be ground over and over, and they then come up as fine as flour, and appear more like clay than sand.

Specimens also change very perceptibly in color by age, some bleaching in the light, others growing darker.

§ 408. *A well-record should be made at the well*, and nowhere else. There a person can see the sand-pumpings as they come up; examine the tools, which show unmistakably the character of the rock they have been working upon, by being either sharp or dull, scratched or polished; and converse with the drillers, who alone can tell at what point a change of rock occurs.

A record thus made should never be altered, even if the

descriptions given do not always exactly fit the specimens preserved.

§ 409. *How specimens should be collected.*—When a well cannot be visited by the person who wishes to st‥ly its record, a duplicate set of sand-pumpings should be kept by the drillers. It can easily be done in this way:

Dump the sand-pump into a pail; let the sediment settle; pour off the top; take a handful of the sediment and dry it immediately; then wash out an equal quantity and dry that. Put them in small paper bags and mark plainly the depth from which they came, and the thickness of rock they represent.

It is also a good plan to put on the date.

From specimens thus kept a very satisfactory study of the character of the measures drilled through could be made at any time.

cally engaged in the past, and are still employed in the deposition and building up of this class of rocks.

§ 430. *Sedimentary rocks* are defined by Lyell, as those which "are formed from materials thrown down from a state of suspension or solution in water."

This definition, at first sight, seems hardly broad enough to cover the ponderous mechanical sediments of conglomerate and sandstone composing the oil sands. But a second thought will vindicate its correctness, for even the largest pebble of the conglomerate must have been, temporarily at least, held in suspension by the energy of the transporting current as it was swept along rolling or ricochetting near the bottom.

Sea-beaches of sand and gravel which were thrown up along shore by waves and winds, high above ordinary tide level, belong also as truly to the sedimentary series when sunken and covered with other stratified deposits as do the accumulations of finer materials at a distance from the shore—which have been in a more literal sense, "held in a state of suspension in water."

§ 431. *If then the oil sands are of sedimentary origin*, it therefore follows that they could only have been laid down in oceans, lakes, or rivers, beneath the water level, or at or near its surface.

The forces employed in their construction could only have been those prevailing through aqueous conditions, and they are the same, and no others, that are possessed by water to-day, to wit: The buoyancy of the fluid, the transporting capacity of swift currents and the tremendous energy of rolling waves and dashing breakers. These forces, in connection with probable terrene oscillations causing alterations in relative levels of land and water, are sufficient to account for all the phenomena discovered in studying the structure of the sedimentary strata.

§ 432. *What the component materials of the oil group are*, may readily be ascertained by an inspection of the contents of sand-pumps, coming up from thousands of drill-holes, scattered throughout the oil district, and by an examination of the exposed portion of the out cropping oil

measures and the coal rocks above them, as seen in northwestern Pennsylvania—for both masses appear to be generically the same, and have evidently been deposited under similar conditions.

The materials vary from coarse conglomerates containing quartz pebbles occasionally two inches in diameter, through all grades of conglomerates, down to pebble-sand, sandstone, sandy-shale, slate, and the most finally levigated mud-rock or "soapstone" of the driller.

§ 433. *With such forces in action* as are enumerated above, varying in energy abnormally, with winds, and tides, and storms; affected by changes of levels, intensifying their powers at one time in this place, at another time in that, and with such heterogeneous materials to work upon, as the resultant strata indicate, we could only expect to find our oil-sands and their associates, (as indeed we do find them,) a variable mass of pebble, sand and shale beds, laid down locally with great irregularity and disorder, within the areas most sensibly affected by these changing conditions.

§ 434. *Water as a vehicle of transportation* for substances of greater gravity than itself, is strong or weak in proportion to the velocity with which it moves. It follows, then, that *the character of the sediment laid down is an index of the strength of the current depositing it.*

The oil-sands are frequently massive conglomerates, made up of the coarsest materials to be found in the formation to which they belong; the influence is unavoidable, therefore, that they owe their origin to the action of the strongest depositing currents prevailing at the period of their deposition. There are but three classes of currents that may be presumed to possess the adequate requisites for the performance of this kind of work, *river currents, deep-sea currents and shore currents.* Let us see which one of these has left the recognizable marks of its paternity upon the rocks in question.

Fluviatile Currents.

§ 435. In attempting to refer these sandy deposits to fluviatile currents, many objections present themselves, al-

requisition; and finally the gas pressure in the barrel becomes so weak that a vent hole must be made to admit atmospheric pressure before the barrel can be completely emptied even by the pump.

§ 476. *The flooding of an oil district is generally viewed as a great calamity*, yet it may be questioned whether a larger amount of oil can not be drawn from the rocks in that way than by any other, for it is certain that *all* the oil cannot be drawn from the reservoir without the admission of something to take its place.

If one company owned all the wells drawing upon a pool, and had accurate records of the depths and characteristics of the oil producing stratum in each well, it is quite possible that some system might be devised by which water could be let down through certain shafts, and the oil forced towards certain other shafts where the pumps were kept in motion, and thus the rocks be completely voided of oil and left full of water. As it is however, no systematized plan of action can be adopted. The careless handling of one well, by which water is let down to the oil rock, may spoil several others belonging to different parties. A clashing of interests at once arises and is likely to result in disaster to the whole district.

§ 477. *The early operators on Oil creek* knew nothing about "*casing*." Wells were drilled "*wet*" no effort being made to shut out the surface water; consequently when oil was struck, it met a static pressure of water corresponding to the depth of the well. In new and shallow territory the pressure in the rock was sufficient to hold the water in check and prevent it from entering the oil sand and sometimes it had force enough to eject a column of water from the hole and flow on steadily for some time in defiance of it. But as developments progressed and oil currents began to be diverted towards numerous outlets through pumping and flowing wells, it often very naturally occurred where the circumstances favored it, that this column of water in a well just completed would force itself into the oil sand, driving the oil before it, and quickly flood a neighboring well. When the new well was tubed and seed-bagged it frequently

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took several days pumping to relieve the sandrock of the water thus forced into it, and regain the oil. These troubles increased more and more as territory became older and the pressure of gas in the rock decreased through the removal of large bodies of oil. At that time the seed-bag which prevented the surface water from passing down, was affixed to the tubing, and any difficulty in the working chamber or valves which necessitated the withdrawal of the tubing, (and these contingencies occurred frequently,) involved the letting in again of the surface waters upon the oil rock. Frequent repetitions of this operation finally brought ruin not only on the well itself but on others in the vicinity. In the abandonment of a well thus spoilt, or of one which had been drilled and proved unproductive, no care was taken to prevent the water from entering the oil rock. Indeed it seemed to be a satisfaction to those who had been unsuccessful in their ventures, to spoil if possible the good wells of the more fortunate. From these causes it happened that nearly all the farms along oil creek were very much injured by water before the true situation of affairs was rightly understood.

§ 478. *Small casing* ($3\frac{1}{4}''$) *was first introduced in 1865.* This held the seed bag on its lower end and extended down below the fresh water veins, so that the tubing could be inserted inside of it and withdrawn at pleasure without letting in the water (see Plate XIV). Many of the old wells were then cased—the abandoned holes were filled up or stopped with a wooden plug above the oil sand to prevent the further admission of water—large pumps were set in motion to exhaust the water and after great expenditures and persistent effort some tracts were partially reclaimed and certain wells yielded oil freely, for a time. But conflicting interests and a want of coöperation among the many well owners prevented systematic work, the flood consequently again became unmanageable, and large areas of old oil territory were finally abandoned.

§ 479. *The manner in which water invades and takes possession of the oil sands*, has created a great deal of discussion among well owners and others. Some producers

have imagined they so thoroughly understood the subject that they could go ahead and put down new wells or operate old ones in flooded territory, in such a way as to catch the oil driven before the water-wave and make a profitable business of it; but they have generally been convinced by experience if they persisted in their operations long enough, that success in this kind of oil producing might be attributed to chance quite as reasonably as to good judgment.

It is an easy thing to *theorize* as to how the water currents *might* conduct themselves, but quite another to show precisely how they *do* act, for we can only have, at best, a very imperfect knowledge of the constitution of the sand-rock, and therefore cannot foresee all the contingencies dependent upon details of structure, which may arise to thwart the most shrewd and judicious calculations.

§ 480. *In judging of the probable effects of the introduction of water* into any particular oil district several things are to be considered.

(1) *The time of flooding*—whether early in the progress of development, while yet a large percentage of oil remains unexhausted, or at a later period after the supply has suffered from long continued depletion. (2) *The structure of the rock*—whether regular and homogeneous throughout, or composed of fine sand interbedding connected and irregular layers of gravel, sometimes lying near the top and at others near the bottom. (3) *The shape of the area being flooded.* (4) The position of *the point at which water is admitted*, in relation to the location of the surrounding wells still pumping oil (5) *The height* (which governs the pressure) *of the column of water* obtaining admittance. (6) *The duration of the water supply.*

It will readily be seen that a *temporary flooding* in comparatively *fresh territory*, such as frequently occurred in early days along Oil creek from the drilling of new wells without casing or the overhauling of old ones where the seed bag was attached to the tubing in the primitive way, must necessarily be quite a different affair from one caused by a *permanent deluge* through unplugged and abandoned wells in *nearly exhausted territory.*

and to prevent it from attaining too great speed, it is checked by pressing the lever, *e*, backward so as to throw the friction pulley *w*, against a post, or a curved piece of sheet iron set behind it in proper position to act as a brake when the wheel is pressed against it.

The sand-pump line is coiled upon the shaft, *x*. It is a cable laid rope $\frac{7}{8}$ of an inch in diameter, and passes direct from the shaft over the pulley, *ii*, and thence down inside of the derrick to the well mouth, where it is secured to the bail of the sand-pump.

Sand-pumps and bailers of several kinds are in use. The most common one is a plain cylinder of thin galvanized iron with a bail on top, and either a leather flap-valve or a metal stem-valve in the bottom. It is usually about 6′ long, but when large quantities of water or oil are to be dipped from the well, it may be lengthened to 15 or 20 feet. Stem-valve bailers are much esteemed on account of their convenience in discharging contents. The valve stem projects downward a few inches beyond the bottom of the cylinder. To empty the pump it is only necessary to let it rest on the bottom of the waste-trough, when the stem opens the valve and the sediment escapes. The flap-valve pumps are emptied through the top, by inverting them.

Other sand-pumps are made of wrought iron casing and in addition to the bottom valve they have a plunger attached to an iron rod which passes through a hole in a stirrup spanning the top of the case. The sand-pump line is secured to an eye in the top of this rod and the pump chamber hangs suspended from the bottom of it—held by the plunger, which cannot pass through the hole in the stirrup. When the pump stops at the bottom of the well, the slack of the rope allows the plunger and rod to settle down into the pump chamber; consequently on an upward movement the plunger and rod start first and travel the length of the cylinder drawing in the sediment from the bottom; but when the plunger reaches the stirrup the cylinder starts upward also, closing the lower valve and retaining the sediment thus drawn into it to be delivered at the well-mouth.

§ 523. *The bull-wheels, bb*, are driven by the "bull-

Chapter XXIX.

(Illustrated by Plates XIV, XIV bis, XV and XXXIX.)

Different methods of drilling and pumping oil wells from 1861 to 1878. Progressive improvements. Relative cost of wells, &c.

§ 546. *Every oil well shaft is naturally divisible into three sections: First*, unconsolidated deposits—surface clay and gravel. *Second*, stratified rocks containing more or less water—shales and sandstones. *Third*, stratified rocks seldom water bearing—slates, mud rocks, shales and sandstones, including the oil sands of the different districts.

The first division always requires a conductor-pipe or casing of some kind to prevent caving. It varies in thickness in different localities from four feet to four hundred feet, the deepest accumulations always being found in valleys.

The second division requires no support for the walls, but must be cased to prevent the water contained in it from following the drill down to the oil sand. Its thickness may be one hundred, or six or seven hundred feet, depending on location.

In the third division the bare rocks form the well-wall, and it is not an unusual occurrence to pierce a thickness of ten or fifteen hundred feet of these strata without encountering enough water to supply the ordinary demands of the sand-pump. In Watson's deep well at Titusville, 3300 feet feet of the wall was bare rock, but water had to be poured in at the top to moisten the drillings.

Therefore each of these divisions must be considered separately in describing the well shaft and its appurtenances.

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§ 547. *On Plate XIV* the reader will find sectional drawings of three oil wells representing different periods and designed to show the improvements made in the style of drill-hole and also in its furniture since the year 1861.

As the horizontal and vertical scales of the drawings are the same, ($\frac{1}{20}$ of nature,) the sections necessarily show but a mere fraction of the total length of an ordinary well, for to thus fully represent one only 1500 feet deep, would require a roll of paper 75 feet long.

The "surface section" shows about 4 feet of the well shaft below the derrick floor, and 7 feet of the well fittings above it, and is intended mainly to explain the details above ground.

The "bottom of drive-pipe section" shows about 4½ feet of the well shaft at the junction of the superficial deposits with the bed-rock, being the termination of the *first* division mentioned at the head of this chapter.

The "seed-bag section" shows about 5½ feet at the junction of the water-bearing and non-water-bearing rocks, being the termination of the *second* division as aforesaid.

The "bottom section" shows about 10½ feet of the oil sand, being the termination of the *third* division and bottom of the well.

The artist's representations of shale, sandstone, &c., are merely illustrative, and not by any means typical.

§ 548. *The three cross sections of well mouths* drawn to natural scale (see Plate 14, bis.) will materially assist one in understanding the details of conductor, drive-pipe, casing, tubing, sucker-rods, &c., as seen in the wells on Plate XIV.

No. 1 belongs to the well of 1861, *No. 2* to the well of 1868, and *No. 3* to the well of 1878. As these drawings represent the actual dimensions of the drill holes and all the materials belonging to them that can be seen in cross sections of the well mouths, they present the facts in a very clear and comprehensible manner, and need no further comment.

Fig. No. 1.—Well of 1861.

§ 549. *The primitive style of drilling and tubing an oil well* is illustrated in Fig. No. 1, Plate XIV. It shows a simple wooden conductor* with a 4-inch "wet hole" continuing down below it to the oil sand, and a string of tubing having an old fashioned seed-bag attached to it.

By this method of drilling, as the hole was generally nearly filled with water from the gravel-beds, and kept so by it and accessions from lower water-courses, it was not possible to note exactly where the lowest water-vein was passed; consequently the point for seed-bagging became a matter of doubt, and frequently the tubing had to be drawn several times to change the position of the seed-bag, before the water could be effectually shut off.

It is desirable always to stop the water as near as possible to the bottom of the stratum where it enters the well, for if it be allowed to pass down the shaft below the impervious rocks immediately underlying its natural horizon, it may find access into some more porous stratum beneath it, and pass through into and flood adjoining wells which are seed-bagged in a higher geological plane.

§ 550. *In preparing to tube a "wet hole,"* the point at which the seed-bag is to be placed must first be decided upon. Suppose it to be 300 feet from the bottom. Then the tubing is carefully measured joint by joint, and 300 feet (less the length of the working-barrel, and whatever distance is to be left between it and the bottom of the well,†) is placed in a pile upon the derrick floor. The working-

* The conductor plank in Fig. 1, is shown by scale as one inch thick. It should have been two inches.

† Sometimes the working-barrel was put 20 or 30 feet, or even more, from the bottom of the well, on the theory that the pump worked more effectively when placed as near as possible to the point at which the oil was supposed to come in. But this resulted in many expensive accidents, for if the tubing chanced to part above, it would be ruined by so great a fall. To prevent this an anchor, or piece of perforated tubing of the proper length should be put below the working-barrel, reaching to within three inches of the bottom, and thus, while the tubing hangs suspended from the top, (which keeps it much straighter than if it rested on the bottom,) it cannot fall to its injury if a break occurs in it.

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barrel is first put in the well and held by clamps fitting under the thimble; then a swivel attached to the tubing cable, which runs up over the crown-pulley and down to the bull-wheels, is screwed into a joint of tubing, and it is elevated and screwed fast to the working-barrel; the clamps are opened to allow the thimble to pass, and the tubing is lowered into the well until the upper thimble rests upon the clamps; the swivel is unscrewed and put into another joint, which is manipulated in the same manner, and thus the work of tubing goes on until the point for seed-bagging has been reached. Now a pause is made and a leather bag like a boot-leg, two or three feet long, and when expanded exactly fitting the well bore, is slipped over the tubing and securely fastened to it by wrapping its lower end with cord. The wrapping is put immediately under a thimble, to prevent the bag from slipping up as it goes into the well, for if the bag be a little too large, or a contracted spot occurs in the shaft, the tubing may have to be forced down occasionally by levers at the top. After the bottom has been tied, the bag is packed with common flaxseed, and a ring having the same diameter as the well bore is passed over it to make sure that it is of proper size. The top is then tied like the bottom, but not so securely (for it is designed to break loose here and turn, when the tubing is to be drawn out,) and it is lowered into the hole by adding the remainder of the tubing joint by joint, as before, until the amount required to place the seed-bag in the position designed has been put in, when the head-block is screwed up, the clamps are permanently secured beneath the thimble by inserting the safety-bolt, and the tubing is ready to receive the sucker-rods.

§ 551. *The sucker-rods are introduced* in a similar manner to the tubing; but as the tubing is full of water, which the rods must displace and cause to flow over at the top as they descend, they can frequently be inserted the first time by hand, without the assistance of pulley-rope or swivel. Indeed, when they are dry and somewhat crooked they require considerable downward pressure to overcome the buoyancy of water and friction against the tubing. After

the rods are in and connections with the walking-beam made, the well is left over night to allow the seed-bag time to moisten and swell so that it may fit sungly to the walls of the well.

§ 552. *When the pump is started*, it can draw its supply only from the well chamber below the seed-bag, if the latter is effective and accomplishes the purpose intended. Hence (provided there are no water veins below the seed-bag) the water is soon pumped out from the bottom of the well, the oil-rock is relieved from its pressure, and the oil and gas now meeting with no opposition, come into the chamber and pass up through the tubing as the water exhausts.

§ 553. *Very grave defects* were soon discovered in this method of managing oil wells. Ordinary wear and tear of machinery or accidental break-downs often made necessary the removal of the tubing before repairs could be made, and this could not be done without disturbing the seed-bag and again letting down the surface water in full force upon the oil-rock. In new wells and new territory this might be fraught with little damage; but in an old district, after large bodies of oil had been drawn from the sandrock, it often proved disastrous. Consequently some plan had to be devised whereby the tubing could be withdrawn at pleasure without disturbing the seed-bag, and the first one adopted was to shut the water off by inserting 3¼-inch casing, as will be described below.

Fig. No. 2.—Wells of 1868.

§ 554. No great changes were made in the style of drill hole or the methods of drilling between the years 1861 and 1868. All parts of the machinery and tools employed were made heavier and stronger, of course, for the shafts were larger and deeper, but the wells of 1868 were still drilled as before, through a simple drive pipe or conductor, the holes being full of water while drilling, and remaining so until the pumping machinery was put in motion.

Fig. 2 shows a cast iron drive pipe* instead of a wooden conductor, through which a plain 5½ inch hole was sunk to the oil rock.

§ 555. *To introduce the 3¼" inch casing* was the first step in preparing to tube a well of this date. On the bottom of it was affixed the seed-bag, and consequently the length of casing required depended upon the distance the base of the water bearing rocks lay below the suface. In some wells one hundred feet would suffice, in others three or four hundred were necessary. Sometimes an ordinary seed-bag was used, and sometimes a patent water-packer consisting of a heavy iron ring a quarter of an inch smaller than the size of the hole, supporting a leather cup similar to the leathers on the cup valve used in the pump barrel. The rim of the cup is thrown open and held against the walls of the well by static pressure as soon as the water below it commences to exhaust.

But as the casing was a *permanent fixture* intended to remain in place for years, or as long as the well lasted, many well owners preferred to put on both styles of seed-bags one above the other as shown in Fig. 2.

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*The following note from Report II, page 136, may very properly be reprinted here:

"Where it is suspected that the floor of the drift lies too deep to be reached by digging, cast iron "drive-pipe" is used. This pipe is cast in sections about 9' long. A space of 4" at each end is carefully turned in a lathe to a certain gauge, and the end is cut smoothly at right angles to the axis of the pipe, so that the joints will stand perpendicularly one upon the other. A joint of pipe is placed on end in the center of the derrick between two "guides," which have been temporarily erected for the purpose of driving it. A heavy "mall" working between these guides is raised and dropped upon the pipe, slowly forcing it into the ground, precisely as piles are driven for docks, bridges, &c. When the top of a joint has been driven to the level of the derrick floor a band of wrought iron, made to fit the turned ends of the pipe, and heated red hot, is quickly slipped upon the end of the driven pipe and another joint at once set up. The contraction of this band in cooling holds the two joints firmly together, and the driving process then goes on. In this way joint after joint is added and driven until solid rock is reached. As many as 23 joints have been used in a well. Great care is required when so long a "string of pipe" is driven to keep it straight and perpendicular, a broken bank, or a large bowlder encountered may cause the pipe to so far deviate from the perpendicular as to necessitate the abandonment of the well. To avoid this the pipe should be frequently cleaned out by the drill while being driven.

The casing-head was screwed to the top of the casing and formed a substantial head block for the tubing to rest upon. It was very similar to the one shown in Fig. *a*, Plate XXXIX.

§ 556. *Tubing.*—The work of casing completed, the next step was to insert the tubing. As the inside diameter of casing was 3¼ inches, and the outside diameter of tubing thimbles or collars 2¾ inches, the latter moved freely inside of the former, and could be put in quickly, there being no delay for seed-bagging, and no measurements necessary. An anchor was put below the working-barrel, and the tubing added on until it struck bottom, when a mark was made on the tube projecting from the well mouth, and the whole string drawn up again to the first thimble. After taking off the first joint, another of proper length, with the casing flange attached to its top was substituted for it, so that when lowered again into the well the tubing would be suspended from the casing head, and the anchor swing just clear of the bottom.

§ 557. *Pumping.*—If the seed-bag proved effective, the space between tubing and casing was quickly relieved of water when the pump was put in motion, and as its surface lowered in the well a partial vacuum formed above it, as was plainly demonstrated by the force with which the air rushed into the well chamber on opening the stop cock at the casing-head. When the water surface drew down below the oil vein, a reaction occurred; the well chamber quickly filled with gas and oil, the former turbulently seeking an exit at the casing-head, while the latter was drawn into the pump barrel as the water at the bottom exhausted, and gradually filling the tubing from the bottem expelled the water at the top, and made its appearance at the delivery pipe in due time.

§ 558. *Water Pump.*—In situations where water was needed for boiler use, a ¾ inch pipe and pump were run down between the casing and well-wall into the water chamber above the seed-bag. Its little sucker-rod of ½ inch pipe or of iron rods was attached by a clamp to the

polished rod * of the oil well, and thus by working constantly furnished all the water required.

§ 559. *Defects in these methods of managing wells.*—Although the well of 1868 was a great improvement over the well of 1861, still it did not meet all the requirements of the situation. In deep shafts the presence of water in the hole greatly retarded the speed of drilling, and it was realized that a column of water a thousand or fifteen hundred feet in height must have an injurious effect upon the oil rock. Experience proved also that many accidents were possible which necessitated the drawing of the casing before the wells could be put in running order; for the cased part being only 3¼ inches in diameter, and that below it 5½ inches, adequate fishing tools could not be introduced when any serious accident happened from dropping tubing, &c. And again, if the well needed to be cleaned out or sunk deeper only a 3¼ inch hole could be drilled, and that with tools necessarily so light that the work was slow and unsatisfactory. These and other considerations naturally led to the experiment of drilling through large casing, and this was found to be so great an improvement over the old plan that it soon entirely superseded it.

No. 3.—Wells of 1878.

§ 560. This well differs from the last described in many particulars. Its drive-pipe consists of an eight inch wrought

* The polished rod is a bar of cold rolled iron 12′ long and 1½″ in diameter, having on one end a box to fit the sucker-rod pins, and on the other a thread for a swivel. In conjunction with the adjuster, it affords a ready means for connecting the sucker-rods to the walking-beam without the delay of cutting the rods to the exact length required. The adjuster is attached by its bearing to the walking-beam, and by means of set screws can be clamped immovably to the polished rod at any point, when it becomes a cross head pivoted upon the walking-beam, and supporting and operating the sucker-rods in the well. After the sucker-rods are put in the tubing, and the working-valve rests upon the standing-box at the bottom, the upper joint of rods may project above the well mouth a few inches or three or four feet. The walking-beam is now put in position, and the polished rod is run up through the adjuster and screwed to the sucker-rods. Then by means of the sucker-rod rope and swivel on top of the polished rod, the whole string of rods is raised as much as is required to give the necessary play between the pump valves, when the polished rod is clamped in the adjuster, the swivel is detached and the well is ready to pump.

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iron tube armed at the bottom with a steel shoe and driven to the rock as described in the previous chapter. The 8 inch jars, bit and reamer, mentioned among the drilling tools are employed while sinking this pipe. After it has been driven to bed rock the 8 inch hole is continued down to the base of the water bearing strata, one, two, or three hundred feet as the case may be, when drilling is suspended and another tube 5⅝ inches in diameter, (technically called "the casing,") is inserted. Before stopping to case, however, the bits are drawn down gradually to reduce the diameter of the hole from 8 inches to 5½ inches, thus forming a beveled shoulder for the casing to rest upon, into which the collar fitted to the bottom of the casing for that purpose, is ground and seated by revolving the casing a few times while it is resting on the bottom. This usually produces a water-tight joint, but if a little sand-pump sediment be thrown in between the casings it will settle at the bottom and make the joint still more secure.

After casing, the 8 inch jars and bits are laid aside for the regular 5½ inch tools, which pass freely through the casing and cut a hole of that diameter to the bottom of the well.

Quite frequently veins of water are encountered after a well is cased, and if it does not exhaust by sand-pumping, drilling is stopped, the casing drawn, the hole reamed out to 8 inches and more casing put in. In new territory where the depth of the water-bearing rocks is not known, this operation may have to be repeated several times. As wells are now drilled, a contractor is not allowed to continue his work unless he succeeds in effectually shutting off all water before striking the oil rock.

§ 561. *Deep "wet wells"* seldom give much show of oil either on tools or in the sand-pump while drilling, and it is only after they are tubed and exhausted of water that the oil makes its appearance. But in dry cased wells, the moment a vein of oil is tapped it gives notice of its presence and frequently flows out at the surface before the tools can be drawn. Thousands of dollars have been spent in testing hopelessly unproductive wells that were drilled "wet," be-

cause it could not be known until they were tubed and tested, whether they contained oil or not. But with dry casing the owner knows when the well is finished whether it will be productive or not, and all the testing required can be done with a sand-pump. Thus a considerable item of expense is saved to the operator who is so unfortunate as to get a genuine "dry hole" or "duster."

§562. *The average cost of drilling cased wells*, (especially if we take into account the reduced liability to accidents from tool sticking, &c.,) is probably but little if any greater than it would be if they were drilled wet. The additional expense of boring an 8 inch hole two or three hundred feet, and the increased cost for large casing, is often fully offset by the time and money saved in more speedily drilling the remainder of the well. Quite an item in the cost of fuel is also sometimes realized; for a vein of gas may be struck several hundred feet from the bottom of the well, which will fire the boiler until the work is finished.*

§ 563. *Some of the obvious advantages* which a cased well has over the well of 1868 are these:

Fishing operations can be successfully prosecuted, for the bore is of the same size all the way down.

A deep hole, five and a half inches in diameter, can be carried on down without letting the surface water in.

Torpedoes can be put in safely and with better efect.

The water-packer can be introduced on the tubing at

* When gas is obtained from the upper rocks in sufficient quantity to furnish fuel for the boiler during the remainder of the drilling, it is conveyed to the boiler through a two-inch pipe, connected with the casing beneath the derrick floor, as seen in Fig. 3. Just before this gas-pipe enters the fire-box, a quarter-inch steam-pipe from the boiler passes into it through a tee, and terminates in a quarter-inch elbow, which is thus held in the center of the two-inch pipe. Another piece of quarter-inch pipe, with the opening in one end reduced, to less than an eighth of an inch, is then screwed into the elbow with the reduced end pointing toward the fire-box. When steam is let into the small pipe, it vents in the center of the gas-pipe and forms an "injector," which forces a current of gas and steam into the fire-box, while the draft occasioned by it in the lead-pipe, draws in the gas from the well, although the well mouth is entirely open, and also prevents all danger from "back suction." Without an "injector" the burning gas is liable to run back through the delivery pipe to the well mouth, where it will explode and set the rig on fire.

any point desired, either to confine the oil and gas and induce them to flow, or simply to prevent the seepings of salt water which sometimes come in below the casing in quantities so small as to be scarcely noticed while drilling, from reaching the bottom of the well, to the detriment of its oil-production.

Geological Sections.—Plate XV.

§ 564. Placing this plate by the side of Plate XIV, we see that the geological structure of the areas operated upon at different periods has largely directed and influenced improvements in the methods of drilling and the appliances for pumping oil wells. The system of operating which met the requirements of the situation in 1861, would have been worse than useless in the deep territory of 1878. The problem forced upon the oil producers has been how to accomplish a greater depth of drilling without increasing the cost of his well; and it has been worked out with such success by the thousands of energetic, inventive minds, engaged in the business, that the average cost to-day of a well 1500 feet deep is less than one of 500 feet was in 1861, and our present wells are also much more fully equipped, and with a better class of machinery.

§ 565. *A little profile section* at the bottom of Plate XV shows that the additional depth of drilling was not required alone on account of a greater altitude of areas drilled upon, but was due mainly to the southwesterly dip of the oil sands.

§ 566. *Geographical positions of the vertical sections.*—Section No. 1 is typical of the geological structure on Oil creek, near the celebrated Noble well; No. 2, of the higher table lands at Pleasantville; and No. 3 is made from the record of Sutton well, No. 4, near Petrolia, in Butler county.

The distance from No. 1 to No. 3 is about 36 miles. The well mouth of No. 3 is only 324 feet *higher* above ocean level than the well mouth of No. 1; but the oil sand of No. 3 is 846 feet *lower* than the oil sand of No. 1. Therefore

over 70 per cent. of the additional depth of drilling is occasioned by the dip of the oil sand.

Page Plate No. XXXIX.

§ 567. *Explanation of Figures*—Illustrating some of the details of oil-well machinery mentioned in the preceding pages:

	Cost.
a, Casing head for 5⅝ in. casing,	$7 65
b, Sand-pump pulley,	3 25
c, Working-barrel, extra heavy brass, 1¾" dia. (for 2" tubing), 5 feet long,	21 75
d, Upper valve for 1¾ in. chamber,	7 50
e, Lower valve for 1¾ in. chamber,	4 00
f, Water-pump and valves, 1 in. dia.,	14 75
g, Rivet catcher,	2 85
h, Bull-rope couplings, 3 holes, for 1¼" rope,	1 33
Bull-rope couplings, 4 holes, for 2¼" rope,	1 90
i, Armor's water packer,	21 35
k, Jars. See Chapt. XXVIII.	

The cuts and price-list are taken from catalogue of Jarecki Manufacturing company, dated 1876. It will be seen that some of these prices vary considerably from those given in "cost of well at Bradford," in 1878, when well fittings were down to their lowest figures.

§ 568. *The rivet-catcher* is a perforated cup, to be attached to the valve stem above the valve, and is designed to catch broken rivets, in case any should work out of the sucker-rod joints, and prevent them falling upon the working valve, where they would quickly wedge and score the working-barrel—spoiling it, perhaps, for future use, before the pumper was aware that anything was wrong.

§ 569. *The water-packer* only came into general use about the year 1875. It is one of the several improvements upon the old-fashioned seed-bag, made possible by and naturally following the use of dry casing in wells. Its design is to prevent any water that may seep into a well below the casing, from gaining access to the oil sand, and to stop the ascent of gas on the outside of the tubing. The oil and gas are thus confined in the well chamber, below the water-packer, and the diameter of the tube through which they

must pass to reach the surface, is reduced from 5⅛ inches to 2 inches. As a result, many wells flow when treated in this way, that otherwise would require pumping.

A number of patented packers are in use. The one shown above is simple in construction and effective in operation. It is made of malleable iron and rubber. The top piece, 1, is connected with the bottom, 3, by a slip-joint, the upper tube, 1, passing through the rubber band, 2, and sliding inside of the lower tube, 3. Fig. *i* shows the packer open; to close it as in the well, the top is shoved down so that the flange of 1, rests upon the rubber band, 2. This forces the cone into the rubber band and compresses it against the well walls, and causes the lower part of 1 to project below 3, and on this projecting end of 1 is affixed the working-barrel, when one is to be used. To 1 is attached the 2″ tubing reaching up to the well mouth, and to 3, the "anchor" extending down to the bottom of the well. The length of "anchor" decides, of course, the point at which the well will be packed, for when it strikes bottom the weight of tubing above the packer telescopes the slip-joint, expands the rubber and shuts off all communication between the annular space outside of the tubing above the packer and the well chamber below it.

§ 570. *The "anchor" is* made of a piece of perforated 3¼″ casing, say 6′ long (it must be long enough to receive the working barrel.) This is screwed on to 3. A reducer is inserted in the bottom of the casing, and a proper amount of 2″ tubing is added to make the anchor of the requisite length.

§ 571. "*Packed Wells.*"—A large number of wells in the Bradford district are "packed" in this manner at the top of the oil sand, and they flow periodically several times a day without requiring any attention, for months at a time, except to watch the receiving tank which quickly tells when a falling off in production occurs and an "overhauling" is necessary.

Cost of an Oil Well in 1878. Bradford District.

§ 572. An extensive oil producer in Bradford, McKean

county, gives the following figures in detail to represent the actual cost of drilling and equiping an oil well in December, 1878. But it should be understood that this was a period when both labor and well machinery were at their lowest values:

Carpenter's rig, complete,	$350
Belt, bull-rope, engine "telegraph," water pipes, steam pipes and fittings to connect boiler and engine,	100
Boiler, (20-horse power,) and engine, (15-horse power,) on ground,	750
Contract for drilling, contractor to furnish fuel, tools, cable, sand, pump line, &c., at 65 cents per foot, say 1500′,	975
Casing say 300′, at 80 cents per foot,	240
Tubing, say 1600′, at 20 cents per foot,	320
Torpedo, (almost universally used before tubing,)	100
Packer,	25
Working barrel,	8
Casing head,	3
Tees and elbows to make tank connections,	5
One twenty-five barrel tank,	25
One two hundred and fifty barrel tank,	110
Tank house,	25
Expense of tubing and packing well,	20
Expense for hauling tubing, material, &c., say,	50
Total cost of well, flowing,	$3,106

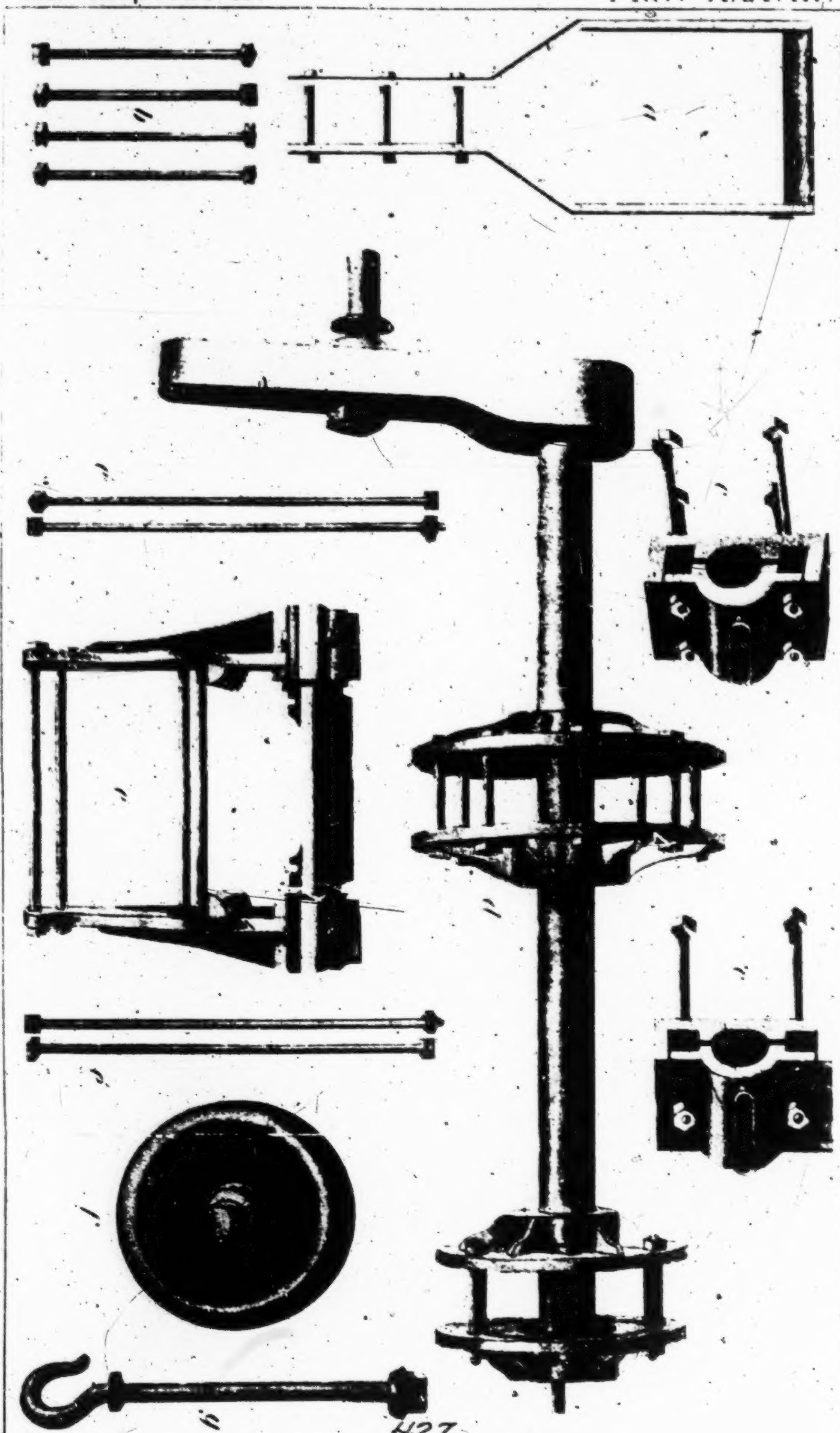
In the above well no "drive pipe" was used, a short wooden conductor set by the rig builder being all that was required. In localities where from 100′ to 280′ of drive pipe casing, costing $1 80 per foot is required, the cost of a well is increased accordingly.

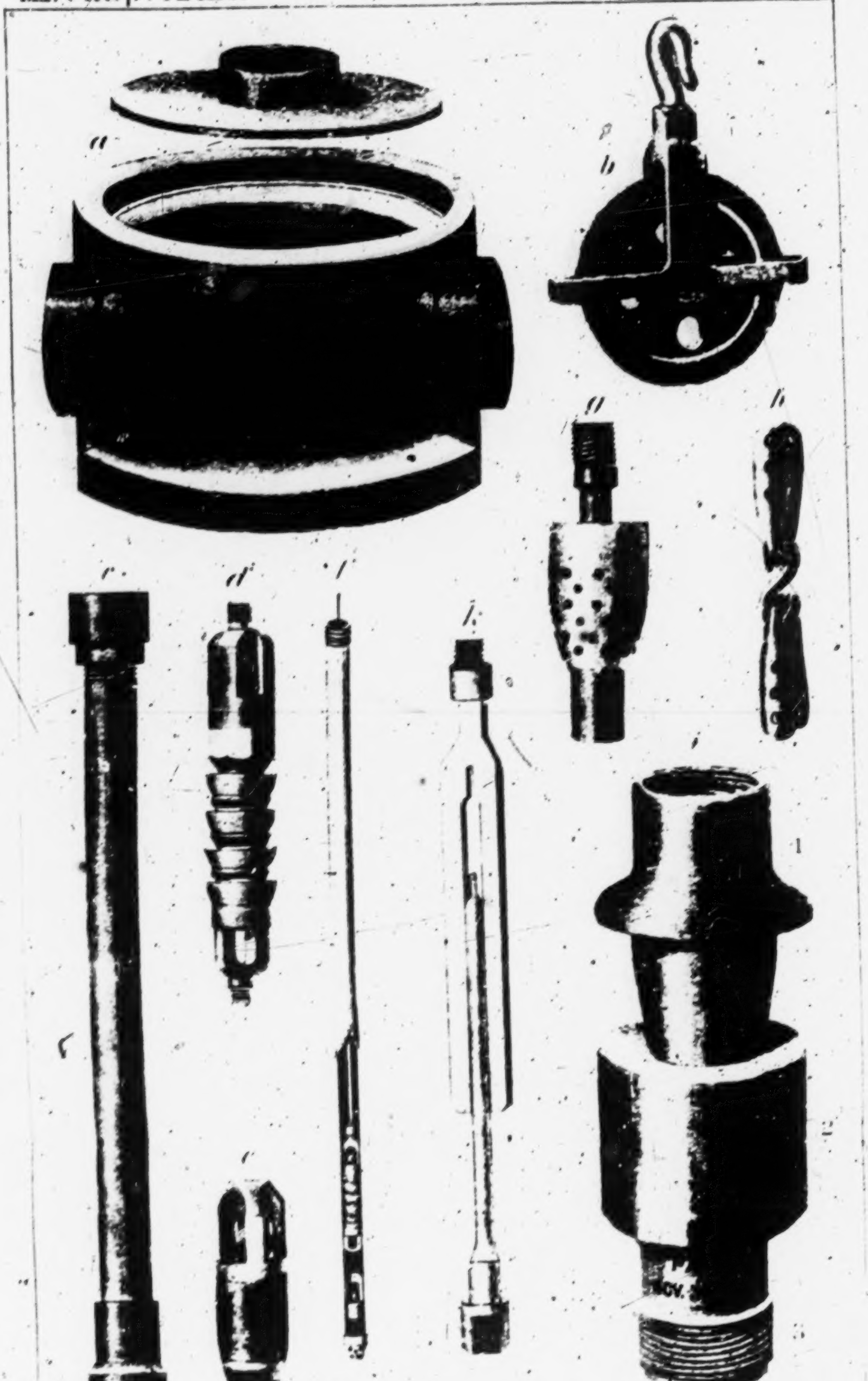
§ 573. If the well is to be pumped the following items are to be added:

1500 feet of sucker rods @5½ cents,	$82 50
Valves for working barrel,	7 00
Polished rod,	2 50
Stuffing box,	1 50
Adjuster,	5 00
Tees and elbows, &c., say,	2 00
	$100 50

§ 574. The necessary tools and implements for handling the tubing and sucker-rods, are—

Large pulley block,	$11 00
Tubing elevators,	9 00
Three pairs of tubing tongs,	10 00

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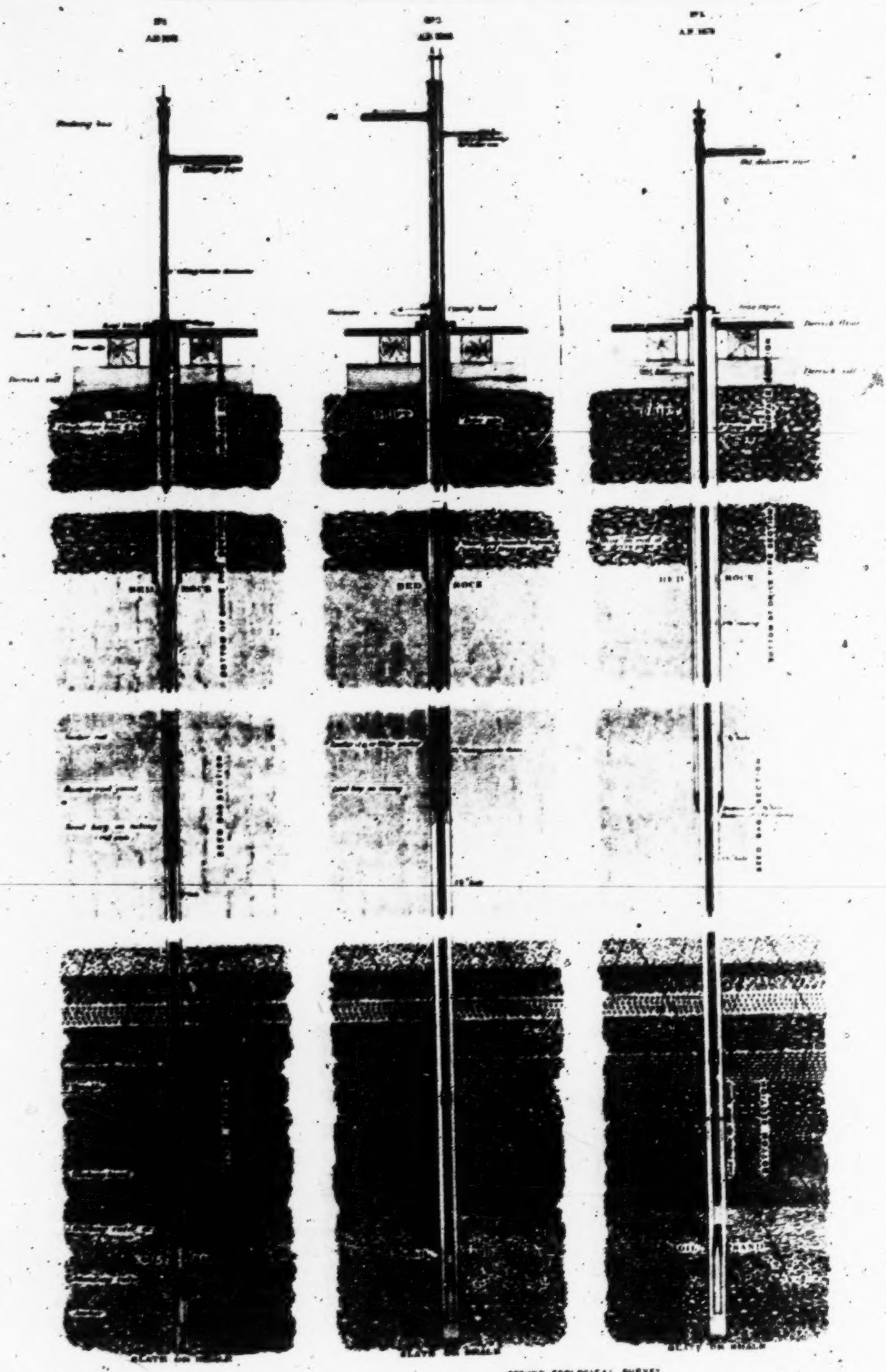

SECOND GEOLOGICAL SURVEY
OF
PENNSYLVANIA

SECTIONAL DRAWINGS OF

THREE OIL WEL

SHOWING SUCCESSIVE VARIATIONS IN ST

DRILL-HOLE DRIVE-PIPE SEED BAG TUBING CASING

429

47TH CONGRESS, 2d Session. } HOUSE OF REPRESENTATIVES. { Mis. Doc. 42, Part 10.

DEPARTMENT OF THE INTERIOR.

CENSUS OFFICE.

FRANCIS A. WALKER, Superintendent, Appointed April 1, 1879; resigned November 3, 1881.

CHAS. W. SEATON, Superintendent, Appointed November 4, 1881.

PRODUCTION, TECHNOLOGY, AND USES OF PETROLEUM AND ITS PRODUCTS.

BY

S. F. PECKHAM.

THE MANUFACTURE OF COKE.

BY

JOSEPH D. WEEKS.

BUILDING STONES OF THE UNITED STATES,

AND

STATISTICS OF THE QUARRY INDUSTRY FOR 1880.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1884.

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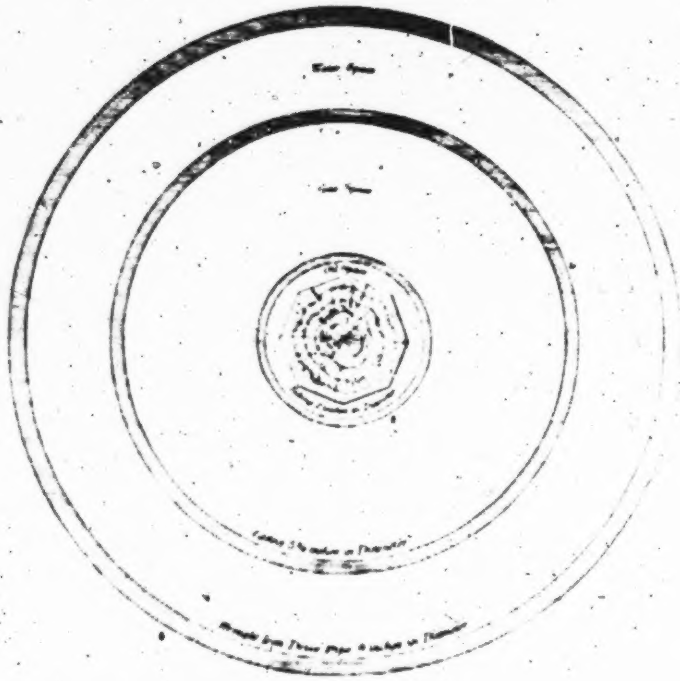
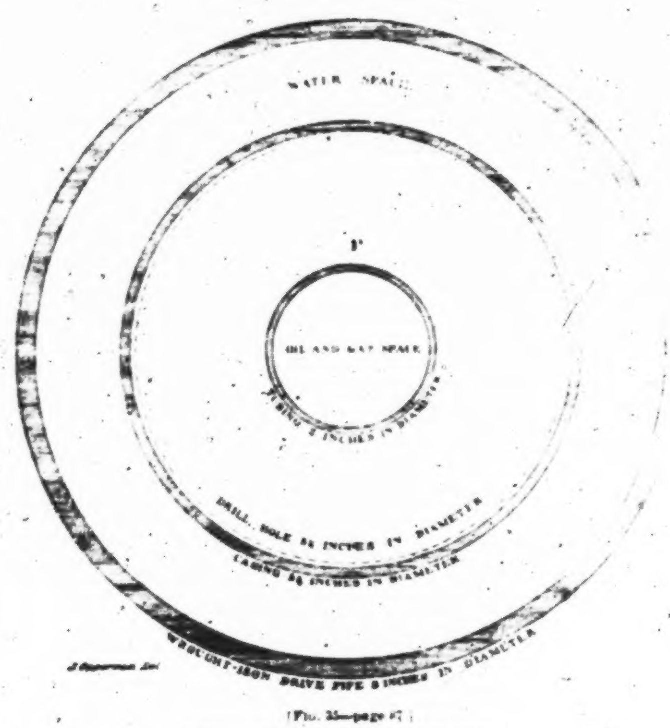


[Fig. 34—page ?]
Cross-section of pumping well, wrought-iron drive-pipe, 1878



[Fig. 35—page 67.]
Cross-section of flowing well, 1880

were rarely found entirely destitute of bitumen as an ingredient. This paper attracted much attention. (a) In 1824 Reichenbach discovered paraffine in the products of the destructive distillation of wood, (b) and in the following year Gay-Lussac analyzed it. (c)

In 1826 the British government sent a second embassy to Ava, and in the journal of that embassy the ambassador, Hon. John Crawfurd, again describes the petroleum wells of Rangoon, and furnishes many details respecting the method of their operation and the amount of their product. (d)

Boussingault investigated the bitumen of Pechelbronn, on the lower Rhine, and compared its peculiarities with those of bitumens from other localities. His work on these substances became very celebrated, and has been very widely quoted. (e) These researches created a lively interest in France, and led to much experimenting upon both solid and liquid bitumens, with a view to ascertaining the purposes to which they might be applied.

During this period the first well was bored in the United States that produced petroleum in any considerable quantity. As the first well bored or drilled for brine was the legitimate precursor of all the petroleum wells in the country, an historical account of it is introduced here, taken from a paper written by Dr. J. P. Hale, of Charleston, West Virginia, for the volume prepared by Professor M. F. Maury, and issued by the State Centennial Board, on the resources and industries of the state. He says:

> It was not until 1806 that the brothers, David and Joseph Ruffner, set to work to ascertain the source of the salt water, to procure, if possible, a larger supply and of better quality, and to prepare to manufacture salt on a scale commensurate with the growing wants of the country.
>
> The Salt Lick, or "the Great Buffalo Lick", as it was called, was just at the river's edge, 12 or 14 rods in extent, on the north side, a few hundred yards above the mouth of Campbell's creek, and just in front of what is now known as the "Thoroughfare Gap", through which, from the north, as well as up and down the river, the buffalo, elk, and other ruminating animals made their way in vast numbers to the lick. * * *
>
> In order to reach, if possible, the bottom of the mire and oozy quicksand through which the salt water flowed they (the Ruffner brothers) provided a straight, well-formed, hollow sycamore tree, with 4 feet internal diameter, sawed off square at each end. This is technically called a "gum". This gum was set upright on the spot selected for sinking, the large end down, and held in its perpendicular position by props or braces on the four sides. A platform, upon which two men could stand, was fixed about the top; then a swape was erected, having its fulcrum in a forked post set in the ground close by. A large bucket, made from half of a whisky barrel, was attached to the end of the swape by a rope, and a rope was attached to the end of the pole, to pull down on, to raise the bucket. With one man inside the gum, armed with pick, shovel, and crowbar, two men on the platform on top to empty and return the bucket, and three or four to work the swape, the crew and outfit were complete.
>
> After many unexpected difficulties and delays the gum at last reached what seemed to be rock bottom at 13 feet. Upon cutting it with picks and crowbars, however, it proved to be but a shale or crust about 6 inches thick of conglomerated sand, gravel, and iron. Upon breaking through this crust the water flowed up into the gum more freely than ever, but with less salt.
>
> Discouraged at this result, the Ruffner brothers determined to abandon this gum and sink a well out in the bottom, about 100 yards from the river. This was done, encountering, as before, many difficulties and delays. When they had gotten through 45 feet of alluvial deposit they came to the same bed of sand and gravel upon which they had started at the river. To penetrate this they made a 3½-inch tube of a 20-foot oak log by boring through it with a long-shanked auger. This tube, sharpened and shod with iron at the bottom, was driven down, pile-driver fashion, through the sand to the solid rock. Through this tube they then let down a glass vial with a string, to catch the salt water for testing.
>
> They were again doomed to disappointment. The water, though slightly brackish, was less salt than that at the river. They now decided to return to the gum at the river, and, if possible, put it down to the bed-rock. This they finally succeeded in doing, finding the rock at 16 to 17 feet from the surface.
>
> As the bottom of the gum was square and the surface of the rock uneven, the rush of outside water in the gum was very troublesome. By dint of cutting and trimming from one side and the other, however, they were at last gotten nearly to a joint, after which they resorted to thin wedges, which were driven here and there as they would "do the most good".
>
> By this means the gum was gotten sufficiently tight to be so bailed out as to determine whether the salt water came up through the rock. This turned out to be the case. The quantity welling up through the rock was extremely small, but the strength was greater than any yet gotten, and this was encouraging. They were anxious to follow it down, but how? They could not blast a hole down there under water; but this idea occurred to them: They knew that rock-blasters drilled their powder holes 2 or 3 feet deep, and they concluded they could, with a longer and larger drill, bore a correspondingly deeper and larger hole. They fixed a long iron drill, with a 2½-inch chisel bit of steel, and attached the upper end to a spring pole with a rope. In this way the boring went on slowly and tediously, till on the 1st of November, 1807, at 17 feet in the rock, a cavity or fissure was struck, which gave an increased flow of stronger brine. This gave new encouragement to bore still further; and so, by welding increasing length of shaft to the drill from time to time, the hole was carried down to 28 feet, where a still larger and stronger supply of salt water was gotten.
>
> Having now sufficient salt water to justify it, they decided and commenced to build a salt furnace, but, while building, continued the boring, and on the 15th January, 1808, at 40 feet in the rock and 58 feet from the top of the gum, were rewarded by an ample flow of strong brine for their furnace, and ceased boring.
>
> Now was presented another difficulty: how to get the stronger brine from the bottom of the well, undiluted by the weaker brines and fresh water from above. There was no precedent here; they had to invent, contrive, and construct anew. A metal tube would naturally suggest itself to them; but there were neither metal tubes, nor sheet metal, nor metal workers, save a home-made blacksmith, in all this region, and to bore a wooden tube 40 feet long, and small enough in external diameter to go in the 2½-inch hole, was impracticable. What they did do was to whittle out of two long strips of wood two long half tubes of the proper size, and, fitting the edges carefully together, wrap the whole from end to end with small twine. This, with a bag of wrapping near the lower end, to fit as nearly as practicable, water tight, in the 2½-inch hole, was cautiously pressed down to its place, and found to answer the purpose perfectly, the brine flowed up freely through the tube into the gum, which was now provided with a water-tight floor or bottom to hold it, and from which it was raised by the simple swape and bucket.

a P. T., 1823; A. C. et P. (2), xxv, 278.
b P. M. (2), 4, 462.
c A. C. et P. (3), l, 78.
d *Journal of an Embassy to the Court of Ava*, 1831.
e *Constitution of Bitumens*, P. J. (2), ix, 487.

Thus was bored and tubed, rigged and worked, the first rock-bored salt-well west of the Alleghanies, if not in the United States. The wonder is not that it required eighteen months or more to prepare, bore, and complete this well for use, but, rather, that it was accomplished at all under the circumstances. In these times, when such a work can be accomplished in as many days as it then required months, it is difficult to appreciate the difficulties, doubts, delays, and general troubles that then beset them. Without preliminary study, previous experience, or training, without precedents in what they undertook, in a newly settled country, without steam-power, machine-shops, skilled mechanics, suitable tools or materials, failure rather than success might reasonably have been predicted. * * *

For interesting facts in this history of the boring of the first well I am indebted to a MS. by the late Dr. Henry Ruffner, and for personal recollections and traditions I am indebted to General Lewis Ruffner, Isaac Ruffner, W. D. Shrewsberry, Colonel B. H. Smith, Colonel L. I. Woodyard, W. C. Brooks, and others, and my own experiences for the last thirty years. * * *

Other important improvements were gradually made in the manner of boring, tubing, and pumping wells, etc. The first progress made in tubing, after Ruffner's compound wood-and-wrapping-twine tube, was made by a tinner who had located in Charleston. * * * He made tin tubes in convenient lengths, and soldered them together as they were put down the well. The refinement of screw joints had not yet come, but followed shortly after, in connection with copper pipes, which soon took the place of tin, and these are recently giving place to iron.

In the manner of bagging the wells, that is, in forming a water-tight joint around the tube to shut off the weaker waters above from the stronger below, a simple arrangement, called a "seed-bag", was fallen upon, which proved very effective, and which has survived to this day, and has been adopted wherever deep boring is done as one of the standard appliances for the purpose for which it is used. This seed-bag is made of buckskin or soft calfskin, sewed up like the sleeve of a coat or leg of a stocking, made 12 to 15 inches long, about the size of the well hole, and open at both ends; this is slipped over the tube and one end securely wrapped over knots placed on the tube to prevent slipping. Some six or eight inches of the bag is then filled with flaxseed, either alone or mixed with powdered gum tragacanth; the other end of the bag is then wrapped like the first, and the tube is ready for the well. When to their place—and they are put down any depth to hundreds of feet—the seed and gum soon swell from the water they absorb, till a close fit and water-tight joint are made. * * *

In 1831 William Morris, or "Billy" Morris, as he was familiarly called, a very ingenious and successful practical well-borer, invented a simple tool, which has done more to render deep boring practicable, simple, and cheap than anything else since the introduction of steam.

This tool has always been called here "slips", but in the oil regions they have given it the name of "jars". It is a long double link, with jaws that fit closely, but slide loosely up and down. They are made of the best steel, are about 30 inches long, and fitted, top and bottom, with pin and socket joint, respectively. For use they are interposed between the heavy iron sinker, with its cutting chisel-bit below, and the line of auger poles above. Its object is to let the heavy sinker and bit have a clear, quick, cutting fall, unobstructed and unincumbered by the slower motion of the long line of auger poles above. In the case of fast auger or other tools in the well, they are also used to give heavy jars upward or downward, or both, to loosen them. From this use the oil-well people have given them the name of "jars".

Billy Morris never patented his invention, and never asked for nor made a dollar out of it; but as a public benefactor he deserves to rank with the inventors of the sewing-machine, reaping-machine, planing-machine, printing cylinders, cotton-gin, etc. This tool has been adopted into general use wherever deep boring is done, but outside of Kanawha few have heard of Billy Morris, or know where the slips or jars came from. * * *

The Kanawha borings have educated and sent forth a set of skillful well-borers all over the country, who have bored for water for irrigation on the western plains, for artesian wells for city, factory, or private use, for salt water at various places, for oil all over the country, for geological or mineralogical explorations, etc.

Nearly all the Kanawha salt-wells have contained more or less petroleum, and some of the deepest wells a considerable flow. Many persons now think, trusting to their recollections, that some of the wells afforded as much as 25 to 50 barrels per day. This was allowed to flow over from the top of the salt cisterns to the river, where, from its specific gravity, it spread over a large surface, and by its beautiful iridescent hues and not very savory odor could be traced for many miles down the stream. It was from this that the river received the nickname of "Old Greasy", by which it was for a long time familiarly known by Kanawha boatmen and others.

At that time this oil not only had no value, but was considered a great nuisance, and every effort was made to tube it out and get rid of it. It is now the opinion of some competent geologists, as well as of practical oil men, that very deep borings, say 2,500 feet, would penetrate rich oil-bearing strata, and possibly inexhaustible supplies of gas.

In Ohio salt was manufactured at the "Old Scioto salt works", in Jackson county, as early as 1798, from brine obtained from dug wells. In 1808, after the successful boring of the Ruffner well on the Kanawha, bored wells were substituted for dug wells very successfully, and salt-wells were soon in operation in other localities. The valley of the Muskingum from Zanesville to Marietta soon became noted, and the valley of Duck creek, since the center of the Washington county petroleum fields, was first famous for its salt-wells.

The following description is from an article in the *American Journal of Science* (1), xxiv, 63, by Dr. S. P. Hildreth, of Marietta:

Since the first settlement of the regions west of the Appalachian range the hunters and pioneers have been acquainted with this oil. Rising in a hidden and mysterious manner from the bowels of the earth, it soon arrested their attention, and acquired great value in the eyes of these simple sons of the forest. Like some miraculous gift from heaven, it was thought to be a sovereign remedy for nearly all the diseases common to those primeval days, and from its success in rheumatism, burns, coughs, sprains, etc., was justly entitled to all its celebrity. It acquired its name of Seneca oil, that by which it is generally known, from having first been found in the vicinity of Seneca lake, New York. From its being found in limited quantities, and its great and extensive demand, a small vial of it would sell for 40 or 50 cents. It is at this time in general use among the inhabitants of the country for saddle bruises and that complaint called the scratches in horses. It seems to be peculiarly adapted to the flesh of horses, and cures many of their ailments with wonderful certainty and celerity. Flies and other insects have a natural antipathy to its effluvia, and it is used with much effect in preventing the deposit of eggs by the "blowing fly" in the wounds of domestic animals during the summer months. In neighborhoods where it is abundant it is burned in lamps in place of spermaceti oil, affording a brilliant light, but filling the room with its own peculiar odor. By filtering it through charcoal, much of this empyreumatic smell is destroyed and the oil greatly improved in quality and appearance. It is also well adapted to prevent friction in machinery, for, being free of gluten, so common to animal and vegetable oils, it preserves the parts to which it is applied for a long time in free motion; where a heavy vertical shaft runs in a socket, it is preferable to all or any other articles. This oil rises in greater or less abundance in most of the salt-wells of the Kanawha, and, collecting as it rises, in the head on the water, is removed from time to time with a ladle.

coal, the production was so enormous, as compared with the demand, that the market was soon glutted and the price fell to almost nothing. An extended demand, and the partial exhaustion of the territory then being worked, led to better prices in 1865, and the immediate result was the boring of wells over an immense extent of country, from Manitoulin island to Alabama, and from Missouri to central New York. In Europe companies were also formed, and wells were put down wherever an oil-spring existed. In the United States the result was the permanent development of a small territory in southern Kentucky, another still larger in West Virginia and in Washington county, Ohio, and another in Trumbull county, Ohio, at Mecca. In Pennsylvania oil was found at Smith's Ferry, on the Ohio river, in Beaver county, and the hill region lying in the angle formed by Oil creek and the Allegheny river from Tidioute across to Titusville was explored and several localities of great richness were opened up.

Henry, in *Early and Later History of Petroleum*, pages 109 and 110, says:

> The total daily product of all the wells in June, 1860, was estimated at 200 barrels. By September, 1861, the daily production had reached 700 barrels, and then commenced the flowing-well period, with an addition to the production of 6,000 or 7,000 barrels a day. The price fell to 20 cents a barrel, then to 15, and then to 10. Soon it was impossible to obtain barrels on any terms, for all the coopers in the surrounding country could not make them as fast as the Empire well could fill them. Small producing wells were forced to cease operations, and scores of operators became disheartened and abandoned their wells. The production during the early part of 1863 was scarcely half that of the beginning of 1862, and that of 1864 was still less. In May, 1865, the production had declined to less than 4,000 barrels per day.
>
> Commencing at Titusville in 1859, the tide of development swept over the valley of Oil creek and along the Allegheny river above and below Oil City for a considerable distance: then Cherry run, in 1864. Then came Pithole creek, Benninghoff and Pioneer run; the Woods and Stevenson farms, on Oil creek, in like succession, in 1865 and 1866; Tidioute and Triumph hill in 1867, and in the latter part of the same year came Shamburg. In 1868 the Pleasantville oil-field furnished the chief center of excitement.

While this great activity was being displayed in Pennsylvania, the old salt and petroleum region in the valley of the Muskingum, in Ohio, and on the Little Kanawha, in West Virginia, was bored for petroleum, and several wells of great productiveness were obtained. In 1860 an old brine well at Burning Springs, West Virginia, that had yielded petroleum, was cleaned out, the water tubed off, and about fifty barrels of oil per day secured. In the following winter the Llewellyn well was struck at about the depth of 100 feet, and it flowed over 1,000 barrels a day. Several other good wells were secured, when, during a confederate raid, the property was destroyed and the operators were driven away. In 1864 operations were resumed, deeper wells producing a large amount of oil, and speculation and excitement ran to a high pitch. In 1865 operations were successfully undertaken at White Oak, which resulted in developing the most extensive and best known West Virginia territory. From 1860 to 1865 wells were successfully drilled on Cow run and at other localities in Washington county, Ohio.

For more than a century bitumen had been known in southern California between Santa Barbara and Los Angeles, and had also been observed floating upon the sea in the Santa Barbara channel between the islands and the mainland. Early in 1864 this region was visited by an eminent eastern chemist, who was so far misled by false local representations and by gross deceptions practiced upon him as to induce him to make a report upon this as a petroleum-producing region of great richness. This report, and others of a similar character, led to the formation of mining companies representing stock to the value of millions of dollars, all of which, it is needless to add, was lost to the *bona fide* investors. Several hundred thousand dollars were spent in boring wells, but few of them produced sufficient petroleum even to serve as a specimen, and none, so far as I am informed, paid the cost of boring. A few years of effort found the companies with depleted treasuries and no oil, and with a large amount of land and apparatus on their hands. On one estate 5,000 barrels in shooks, shipped from New York, were rotting down in a huge pile before a drop of petroleum had been obtained from beneath its surface. While these magnificent enterprises were becoming magnificent failures, more humble efforts were achieving a measure of success in driving tunnels into the steep mountain sides upon the petroleum-bearing rock. The total production of this region, however, never reached above a few thousand barrels of inferior quality per year, and the San Francisco market continued to be supplied almost exclusively with Pennsylvania petroleum shipped around cape Horn. (a)

From 1870 to 1880 the region between Tidioute and Oil creek has constantly become relatively of less importance when compared with the entire area of producing territory in Pennsylvania. At the beginning of this decade the production of this region had considerably lessened, and a number of new and very successful wells farther down the Allegheny river were attracting attention in that direction. Wells had been put down near the junction of the Clarion and Allegheny rivers as early as 1863 and 1864, but very little notice had been taken of them at the time; and it was not until 1868 that a successful well on the hill above Parker's landing attracted the attention of the bolder operators and led to the development of what is termed the "lower country", lying in Butler, Armstrong, and Clarion counties. In 1867 Mr. C. D. Angell had developed a very productive oil property on Belle island, in the Allegheny river, 25 miles below Oil City. While carrying forward his work he was busily investigating the occurrence of petroleum by studying the relative position of the most productive wells. He had observed in the "upper country" that a narrow belt extending across from Scrubgrass, on the Allegheny river, to Petroleum Center, on Oil creek, included many of the best wells in that region. In the "lower country" he

---

a Advices from the Pacific coast indicate that during the years 1880 and 1881 a petroleum interest that promises some local value has been developed in a portion of the state further north than that here referred to.

exerted in consequence, and (3) the enormous pressure under which the oil is held in the rock and forced out when the reservoir is perforated, there seems to be no reasonable ground for doubting the sufficiency of such a source of supply. This opinion receives further confirmation from the large content of oil proved by Dr. Hunt to exist in the Chicago limestone (see page 63).

J. F. Carll has shown by experiment that the pebble sand will absorb from one-fifteenth to one-tenth of its bulk of oil, and, further, that "the aggregate sum of the pores or interspaces of a sand-rock of this kind, as exposed in the walls of a well of 5½ inches diameter, is equivalent to the area of an open crevice one inch wide, extending from top to bottom of the gravel bed, whatever its thickness may be". He further shows that "on Oil creek there is generally from 30 to 50 feet of third sand, and also from 15 to 30 feet of stray sand, both locally producing oil. Of this total, suppose only 15 feet is good oil-bearing pebble, we shall then have a producing capacity of 15,000 barrels per acre, or 9,600,000 barrels per square mile, which is adequate to the requirements of the most exceptional cases known". (a)

While the Warren and Bradford sands are quite dissimilar from the Venango sand, their porosity is sufficient to hold their content of oil.

The occurrence of so-called slush oil at North Warren and at Limestone, in the Tuna valley, has been attributed to fissuring of the sandstones and shales in such a manner as to allow the oil to rise into the fissures in the shales. These cases are local and exceptional, and are therefore not to be regarded as typical of the manner in which oil occurs generally.

SECTION 8.—THE MANAGEMENT OF WELLS.

Having shown how the oil-well is carried down upon a reservoir of sufficient capacity to contain a remunerative quantity of oil, it will next be shown how the well is managed after it is drilled and torpedoed. The present methods of management are the result of an historical progressive development, which will be best understood if discussed chronologically and in connection with the figures in Plate VI and the sections, Figs. 32, 33, 34, and 35. Figs. 1, 2, and 3, Plate VI, and Figs. 32, 33, and 34 were originally drawn by H. Martyn Chance, to accompany Mr. Carll's report, and were afterward redrawn by Miss Laura Linton, with some changes, to bring them into conformity with Fig. 4, drawn by Mr. Opperman. An examination of these figures shows the well divided into four sections, viz: the surface section, the bottom of the drive-pipe section, the bottom of the casing section, and the bottom section These different sections show the arrangements at the derrick floor, at the bottom of the drive-pipe, at the bottom of the casing or seed-bag section, and at the bottom of the well. Fig. 1, Plate VI, and Fig. 32 show a well as arranged in 1861. It is the direct descendant of the well of the Ruffner Brothers, and was then in use around Tarentum and elsewhere for salt-wells. From the well-head at the derrick floor to the bed-rock was a plank conductor or drive-pipe, which held the loose sand or gravel of the drift. From the bottom of this conductor to the bottom of the well the rocks through which the drill had cut formed the walls of the bore, which was 4 inches in diameter. Within this 4-inch hole a 2-inch pipe was inserted, with the pump-barrel screwed to its lower end. At a point estimated to be below that at which the water infiltrating the surface rocks entered the well the "seed-bag" was fastened in such a manner as to stop off this water from entering the bore of the well below. The pump-barrel being securely screwed to a length of pipe, it was lowered into the well, and piece after piece connected, until the point at which the seed-bag was to be introduced was reached; then a bag of calfskin or buckskin was securely tied to the pipe immediately below a thimble to prevent it from sliding. This bag was filled with flaxseed, and the upper end was so insecurely tied that if the tube was raised the bag would turn and empty itself. It was then lowered and the pipe added joint by joint until the required amount was put in. Beneath the thimble, at the end of the last joint, clamps were placed and securely fastened above the head-block, which rests upon the derrick floor. As the seed-bag absorbs moisture it expands and fills the 4-inch hole so completely that all of the water above the bag is held and prevented from passing below. Of course this well is drilled wet, that is, full of water, no attempt being made to stop off this water until the oil is reached and the well is prepared for pumping. If for any reason it became necessary to withdraw this tubing, the seed-bag came with it, and the water flowed into the bottom of the well.

Fig. 2, Plate VI, and Fig. 33 show the well of 1868. At this time it had become customary, after sinking the conductor or cast-iron drive-pipe to the bed-rock, to commence a 5½-inch hole, which was continued to the bottom. The position of the seed-bag was then determined, and it was securely fastened to the lower end of a section of casing-pipe 3¼ inches inside diameter. This was lowered to the proper depth. The 2-inch tubing, with the pump attached, was then lowered to the proper depth and secured at the top with the proper clamp. This well was of course drilled full of water, as the water was not stopped off until the tools were drawn out and the casing inserted. Instead of the ordinary seed-bag, a patent packer was sometimes attached to the casing in place of it. This packer was formed by pressing a sort of leather cup over an iron ring that was a little smaller than the drill-hole and was fastened to the outside of the casing. The pressure of the column of water above held the leather firmly to the drill-hole when the oil was pumped from below. Sometimes, as is represented in the figure, both the cup-packer and seed-bag were used at the same time. A casing-head was screwed on, usually with one or two outlets for gas,

a Rep. Sec. Geo. Surv. Penna., III, p. 253.

and the gas that escaped inside the casing and outside the tubing could thus be utilized as fuel: at the same time the casing-head took the place of the head-block and formed a support for the tubing. In this way the casing was made a permanent fixture, effectually stopping off the water and permitting the tubing to be introduced or taken out at pleasure.

Although this method of drilling and casing wells was a great improvement over those previously employed, it still presented two very grave defects: First, the well must be drilled full of water, and, second, the hole was larger than the casing, and accidents sometimes occurred, which made it necessary to draw the casing and let the water into the well. To remedy these defects the plan was adopted that is shown in Fig. 3, Plate VI, and Fig. 34. According to this plan an 8-inch iron pipe is driven to the bed-rock. An 8-inch hole is then carried down below the surface water. The drilling-bits are then made smaller, and the hole is contracted to 5¼ inches. A second tube, armed with a steel shoe, is then carried down inside the drive-pipe, and ground in the tapering drill-hole to a water-tight joint. This casing thus effectually cuts off the water. The 8-inch jars and drills are exchanged for 5¼-inch tools, and the hole is carried down from that point of the same diameter as the interior of the casing to the bottom of the well, with only water enough introduced to sand-pump properly. The buoyancy imparted to the tools and cable by 1,000 to 1,500 feet of water is thus avoided, and the presence of oil in any of the strata penetrated is immediately manifested by escaping gas and soiled tools, and sometimes by a gush of oil that fills and overflows the well before the tools can be withdrawn.

Mr. Carll (Report III, *Second Geological Survey of Pennsylvania*, page 320) estimates that "the average cost of drilling cased wells (especially if we take into account the reduced liability to accidents from tool-sticking, etc.) is probably little, if any, greater than it would be if they were drilled wet. Quite an item in the cost of fuel is sometimes realized, for a vein of gas may be struck several hundred feet from the bottom of the well, which will fire the boiler until the work is finished".

The advantage of having a hole of the same diameter all the way down is very great when fishing operations are necessary, and also when the packers which are now used are to be inserted. These are used in preparing the well for flowing, and their use is represented in Fig. 4, Plate VI, and Fig. 35, where a cased well, with tube and packer, are indicated in full operation. These packers are of rubber, and are so constructed that the tube within them moves in a sliding joint. The lower piece of pipe enters the bottom of the mass of rubber, and the upper section, being securely fastened to the upper portion of the mass, slides in the lower section in such a manner as to press with its whole weight against the rubber and force it against the sides of the drill-hole. A well prepared for flowing as represented in Fig. 4, Plate VI, and Fig. 35, and properly connected with a tank, will operate with very little attention for months. The flow will finally run down either from the exhaustion of the supply or the clogging of the pipes with paraffine.

The clogging of pipes with paraffine occasions a great deal of trouble in the Bradford district. This is occasioned, first, by the much larger percentage of paraffine in the Bradford oil, and, second, from the condensation of the less volatile and soluble paraffines, due to the very intense cold produced by releasing the oil from the high pressure under which it exists in the rock, and consequently rapid evaporation of the more volatile portions. No attempt has been made to ascertain accurately this temperature, but many incidental facts indicate that it is very low.

After a well has ceased to flow, and in those localities where the gas pressure is not sufficient to cause the oil to flow, the well is pumped. In the method of pumping represented in Fig. 1, Plate VI, and Fig. 32 the sucker-rods were introduced immediately after the pipe and seed-bag, and, after the seed-bag had had time to swell, connection was made with the walking-beam, and the water pumped out below the seed-bag. After this water was removed and its pressure taken from the rock the gas and oil entering the well were brought to the surface. With the adoption of the first method of casing wells (Fig. 2, Plate VI, and Fig. 33), the water was removed from the space between the casing and tubing, and the oil-rock being quickly relieved of its pressure, the oil and gas rushed in to supply its place, and after the removal of the water was brought to the surface. With the drilling of dry holes the method of pumping represented in Fig. 3, Plate VI, and Fig. 34 has been adopted. In this well there is no water to pump, and the oil is brought to the surface as long as any will enter the well. Sometimes so-called gas-pumps are applied to wells that have ceased to yield oil and a partial vacuum has been created, with the result of causing the oil to flow laterally into the well through the rock.

In some localities, where the oil is valuable and the yield of the wells small, as among the heavy-oil wells of the Franklin district or in the older portions of the Oil Creek district, a method of pumping wells by sucker-rod connections has been adopted. The use of sucker-rods was no doubt adopted on account of the fact that old rods were suitable, numerous, and cheap. An engine is attached to a circular horizontal table by an elbow-joint in such a manner that it is made to perform a quarter revolution and return to its former position. To the circumference of this table from two to a dozen or fifteen connections are made, in such a manner that each connection is given an equal stroke sufficient to move a pump connection, such as is represented in Fig. 36. The pull of the engine comes on the down-stroke of the pump, and the up-stroke of the pump is balanced by the stones or other heavy material placed in a box on the arm, *a*. The rods by which these connections are made for long distances are

supported by light frames, which have a swinging motion as the rods move slowly to and fro. In the Franklin district, where the wells are shallow, the rods are made of strips of ash $2\frac{1}{2}$ inches square, nailed together by wooden straps. From thirty to forty wells are thus sometimes attached to one engine. In the White Oak district of West Virginia, where the ground is too uneven to admit of wooden connections, motion is communicated to a dozen or more wells by an endless rope, usually of wire, that is supported on wheels and runs up one hill and down another and along the valleys to a convenient site for the engine. By this method wells can be profitably pumped that would otherwise have to be abandoned.

At the Katie Hough well, on Mud run, in the White Oak district, West Virginia, in the summer of 1881, the curious phenomenon was exhibited of pumping two kinds of oil from the same well. In this region there are several oil horizons, and at the point penetrated by this well the first White Oak sand produces oil of 27° specific gravity, and third White Oak sand beneath it yields oil of 45° specific gravity. The well was in 1865 put down 255 feet to the first White Oak sand, and was pumped at intervals for 15 years; it was then reamed to an 8-inch hole, and a $4\frac{1}{2}$-inch hole sunk to the third sand. A tube, with a seed bag at the bottom of the 8 inch hole, was inserted, and the heavy oil stopped off. From this tube amber oil of 45° specific gravity is pumped from the third sand. A second pump and tube was then inserted in the 8-inch hole beside the other tube and proper connections made with the walking-beam, every stroke of which pumped dark, heavy oil of 27° specific gravity from the first sand, worth $7 per barrel, and amber oil of 45° specific gravity from the third sand, worth $1 per barrel. The Shaw well, on Gales' Fork, also in the White Oak district, said to have produced $80,000 worth of oil, pumps oil of 25° specific gravity from a depth of 160 feet and an oil of the specific gravity of 40° at a point between 600 and 700 feet.

It has been the custom around Titusville and Pleasantville, when the production of a well ran very low, to introduce into it five to ten barrels of crude naphtha (benzine), and after allowing it to remain for a few days to resume pumping, an increased production being the result.

The large amount of oil that has at different times and in certain localities run to waste upon the streams has been due to unavoidable waste, to the bursting of pipes and tanks, the sinking of barges, and to oil which has escaped destruction during extensive fires. On the Allegheny river at Oil City may always be seen a thin film of oil often sufficient to produce iridescence. The quantity of oil required to produce this effect, although apparently very small, is in the aggregate quite large. Where booms are stretched across such streams the floating oil is arrested and may be pumped from the surface with water into settling tanks and collected. In this way the collection of oil has been made a profitable business, as occasion might warrant, thousands of dollars' worth having been gathered in a single season that would otherwise have gone to waste. In 1862, 4,000 barrels were dipped from the Allegheny river and was used for lubricating oil and for making lampblack.

The occurrence of oil in the drift gravels beneath the superficial clays south of Titusville has already been mentioned (see page 49). The oil here was pumped from shallow wells, dug only a few feet into the gravel. (a)

SECTION 9.—YIELD OF WELLS.

The average duration of the profitable production of an oil-well is very uniformly estimated at five years, but this period is subject to very great variations. The wells in the Colorado district, northeast of Titusville, have been pumped about twelve years, and have yielded constantly enough to more than pay expenses. In the White Oak district of West Virginia the Scott and Scioto wells, drilled in 1865, were being pumped in 1880. On the contrary, the Cole creek portion of the Bradford field had all been drilled over since 1879, and some of the wells were abandoned before June 4, 1881, while at the same date wells were flowing near Tarport, in the same field, that were drilled in 1875. As a general rule, it may be said that the nearer the wells are to each other on a given piece of property the sooner they will become unprofitable.

As an illustration: On Triumph hill eight wells were drilled in a group, two on the edge of the belt and six nearer the center. As each well was drilled it commenced to yield at the rate those previously drilled were yielding at that time. The first well was drilled in 1866, and yielded an average daily production for the first six months of 70 barrels, the second six months 41 barrels, the second year 35 barrels; it then fell off gradually until it reached 5 to 7 barrels, where it remained for two or three years; it then continued to fall, until for the three years preceding 1881 the yield was only about 1 barrel a day. The eight wells were pumped with sucker-rods by one engine. The six central wells were 9 or 10 rods apart. The sand in the center of the Triumph belt is more than 100 feet thick.

The Economites drilled two wells on their tract upon the hill east of Tidioute 300 feet apart. They started at 100 barrels a day and held it three months, then ran down to 25 barrels in two years, and during the two years following ran down to 200 barrels a week and held about that yield for two years. Two wells were drilled in

a In the summer of 1881 quite an excitement was occasioned in Titusville by the discovery of oil saturating gravel beneath the soil of gardens along the creek. Several hundred barrels were pumped and dipped from holes or pits dug over an area of several acres. It was supposed to have been the leakage from loading racks during the Pithole development.

positions *a* and *b*. They started at 125 barrels each, and in eighteen months ran down to zero. The rigs were then changed to the other side of the engines at *a'* and *b'* and the wells were redrilled. They were drilled deeper into the sand the second time, and were cased with $5\frac{5}{8}$-inch instead of $3\frac{1}{4}$-inch casing. These second wells started off at 75 barrels a day and lasted ten years. The first wells were drilled by a man who had a hobby that 10 feet in the sand is sufficient, but the second wells were drilled through 25 or 30 feet of sand.

a *a'*
b' *b*

The yield of some single wells has been enormous. One half of the Empire well was sold for $900, and it afterward yielded $12,000 in six days. Its owners saved 3,500 barrels a day and sold it for 10 cents a barrel. The owners of the land were unable to furnish barrels, and the royalty was put into pits dug in gravel. Well No. 4, on the Jacob and John Hemphill farm, Donegal township, Butler county, Pennsylvania, struck by McKinney Brothers in September, 1873, has produced about 110,000 barrels, and is still (1881) producing six barrels daily. The farm upon which this well is located is among the most prolific oil properties ever developed, twelve wells thereon producing over 750,000 barrels. The Divner well, No. 1, Divner farm, Butler county, Pennsylvania, has yielded about 200,000 barrels, and six years after being struck produced 13 barrels a day. The Boss well, on the J. A. Parker farm, in Armstrong county, Pennsylvania, produced about 80,000 barrels. The amount yielded by any one well in the Bradford district is much smaller, from 20,000 to 25,000 barrels being probably the highest yield.

SECTION 10.—FLOODING.

The proximity of other outlets appears to determine the duration of the flow of oil-springs or wells. The spring in the island of Zante is known to have flowed two thousand years. The Beatty well, in Wayne county, Kentucky, drilled in 1819, is still flowing, there being no other well near it. The American well yielded oil in large quantities from 1830 to 1860, but after the drilling of other wells in the neighborhood the yield fell off, and finally ceased altogether. It is therefore impossible for any producer controlling a small area to preserve his oil beneath the surface. The lateral flow of oil and water through the oil-sand has been repeatedly demonstrated. Jonathan Watson, in his experience, had known water to run into a well when the seed-bag was removed from another one-half mile distant and in another instance red paint was put into one well and pumped out of another at about the same distance.

J. F. Carll, in Report III, *Geological Survey of Pennsylvania*, page 258, says:

> The National well No. 1 was struck in February, 1866. It was very near the northwesterly edge of a large and well-stored pool, and passed through rather an inferior oil rock as compared with that afterward found on the axis of the belt. Still it had a sufficiently free connection with the supplying reservoir to furnish a delivery of about 85 barrels per day, and it maintained its production with wonderful constancy for two years, having only declined to about 60 barrels in that time. In the summer of 1868 wells were drilled on the center of the deposit from which it had been deriving its supply. Some of these wells produced as much as 150 barrels per day. The effect on the National was immediately apparent. Its production dropped off rapidly and dwindled down to 10 barrels or less a day. * * *
> Harmonia well No. 1 was on the thriving northerly edge of the Pleasantville belt. The main body of oil and the best sand-rock, as afterward demonstrated, lay to the south. It started with a small yield, and at the end of a fortnight was pumping about 30 barrels per day. Gradually increasing its production, as if enlarging and cleaning out the passages leading into the supplying reservoir, it finally commenced to flow, and ran up to 125 barrels, where it remained until wells of larger flow were drilled on the center of the belt and relieved the gas pressure, when pumping had to be resumed. After this it soon fell down to an unremunerative production and was abandoned

The early method of drilling with the well full of water prevented the escape of the oil and gas until the water was pumped out; when the rock is pierced with a hole drilled dry "the effect is similar to the sudden liberation of the safety-valve of a boiler under a full head of steam, * * * "the boiling, foaming mass is driven upward against the forces of gravity", and sometimes shoots high above the top of the derrick. The equilibrium which had been maintained for ages throughout the communicating portions of the rock is suddenly destroyed in the immediate proximity of the well by this sudden rush up the drill-hole, and material gaseous at the ordinary temperature and pressure, but fluid under the enormous pressure maintained in the oil-rock, expands and evaporates as it rushes to the surface. This action goes forward, slowly reducing the pressure upon all the communicating portions of rock, until the pressure on the oil filling the rock is only equal to that of the column filling the drill-hole. The pump is now used to lift the fluid from the drill-hole, the oil being still under the pressure of the gas ascending between the tubing and casing. The rock is still full of oil, and the pumping goes on until the pressure of the gas is scarcely sufficient to send any of it to the surface, when a gas-pump is applied at the casing-head to one of the lateral tubes and the pressure of the atmosphere removed. Still, after all this has been done, there is oil remaining in the rock. As before intimated, the oil and gas mutually dissolve each other and form a homogeneous mass, "the gas being as thoroughly incorporated with the oil as gas is with water in a bottle of soda-water." The effects of "flooding" or allowing water to enter the rock partially exhausted of its oil has been the subject of much controversy. Some producers imagine that if the rock is properly flooded the oil can be driven toward certain points and removed to advantage, but experience has proved such operations extremely hazardous.

J. F. Carll has discussed this subject in great detail, and I am greatly indebted to his report and private conversations for information on this subject. He says: (*a*)

> The first intimation of the flooding of a district is given by an increased production from the wells affected by it. Old wells improve gradually, running up from 5 to 10 or 20 or even 50 barrels. After pumping in this way for some time, the oil quickly fails, and they yield

a J. F. Carll, Report III, p. 265.

only a few barrels of salt or brackish water. * * * In some districts the movement is quite rapid, and wells are invaded and "watered out" in quick succession; in others it is so slow that large quantities of oil are obtained from those which are favorably located to receive a "benefit". Flooding a well is sometimes a very profitable way of closing up its career, inasmuch as it thus yields more in a few months than it otherwise would in years, and when the water reaches it the owner knows at once what it betokens and stops work, thus saving the time and money usually expended in fruitless efforts to reclaim a well failing through natural decline. * * * In judging of the probable effects of the introduction of water into any particular oil district several things are to be considered. (1) *The time of flooding*, whether early in the progress of development, while yet a large percentage of oil remains unexhausted, or at a later period, after the supply has suffered from long-continued depletion. (2) *The structure of the rock*, whether regular and homogeneous throughout, or composed of fine sand interbedding and connected and irregular layers of gravel, sometimes lying near the top and at others near the bottom. (3) *The shape of the area being flooded*. (4) *The position of the point at which water is admitted* in relation to the surrounding wells still pumping oil. (5) *The height* (which governs the pressure) *of the column of water* obtaining admittance. (6) *The duration of the water supply*. It will readily be seen that a *temporary flooding* of comparatively *fresh territory*, such as frequently occurred in early days along Oil creek, from the drilling of new wells without casing or the overhauling of old ones when the seed-bag was attached to the tubing in the primitive way, must necessarily be quite a different affair from one caused by a *permanent deluge* through unplugged and abandoned wells *in nearly exhausted territory*. In the former case the flood may be checked before much water has accumulated in the rock, and then the oil-flow can be reclaimed after a few days of persistent pumping: in the latter, the recovery of the oil is very uncertain, because from its long-continued extraction a greater capacity has been given to the rocks for storing water, and this being supplied from scattered and obscure sources, there is little probability that it can be shut off, although the most thorough and systematic attempts may be made to check it.

The effect of flooding upon adjacent wells is illustrated by the following incident related of the Oil Creek district: A and B owned wells 200 feet apart. A's pumped about 10 barrels a day and B's 30. B wished to pump his, but A thought his would not pay and stopped, when B soon found he could get only water. B offered A $10 per day to pump his well ten days. At the end of ten days A refused to pump, then B offered him $25 a day for twenty-five days, at the end of which time B offered A $30 a day to pump his well an indefinite period, and A consented. In the mean time the oil in B's well increased gradually until it reached 75 barrels a day, and the operation proved profitable.

This flooding of oil territory has been proved of such importance that the legislature of Pennsylvania has affixed a penalty to any neglect to "plug" abandoned wells. The plugging consists in filling them with sand. A moment's reflection will show that the owner of oil territory must have it drilled or it will be exhausted by his neighbors drilling a cordon of wells around his property. After it is drilled, the wells must flow until the pressure of gas is exhausted, or, as has been known in several cases, the casing and tubing will be thrown out of the well. A case is on record where the casing-head was anchored down with chains and the flow of oil arrested, yet the gas pressure tore away the fastenings and threw the casing out through the top of the derrick. After the oil has stopped flowing, if the well-owner does not pump, his neighbor's pumps will drain his territory, and if he "pulls out", the law compels him to fill his well with sand and ruin it forever, to prevent the public injury resulting from letting down surface water into the oil-sand. There is therefore no other alternative presented to the unfortunate possessor of oil territory but to drill and produce, whatever the price of oil may be.

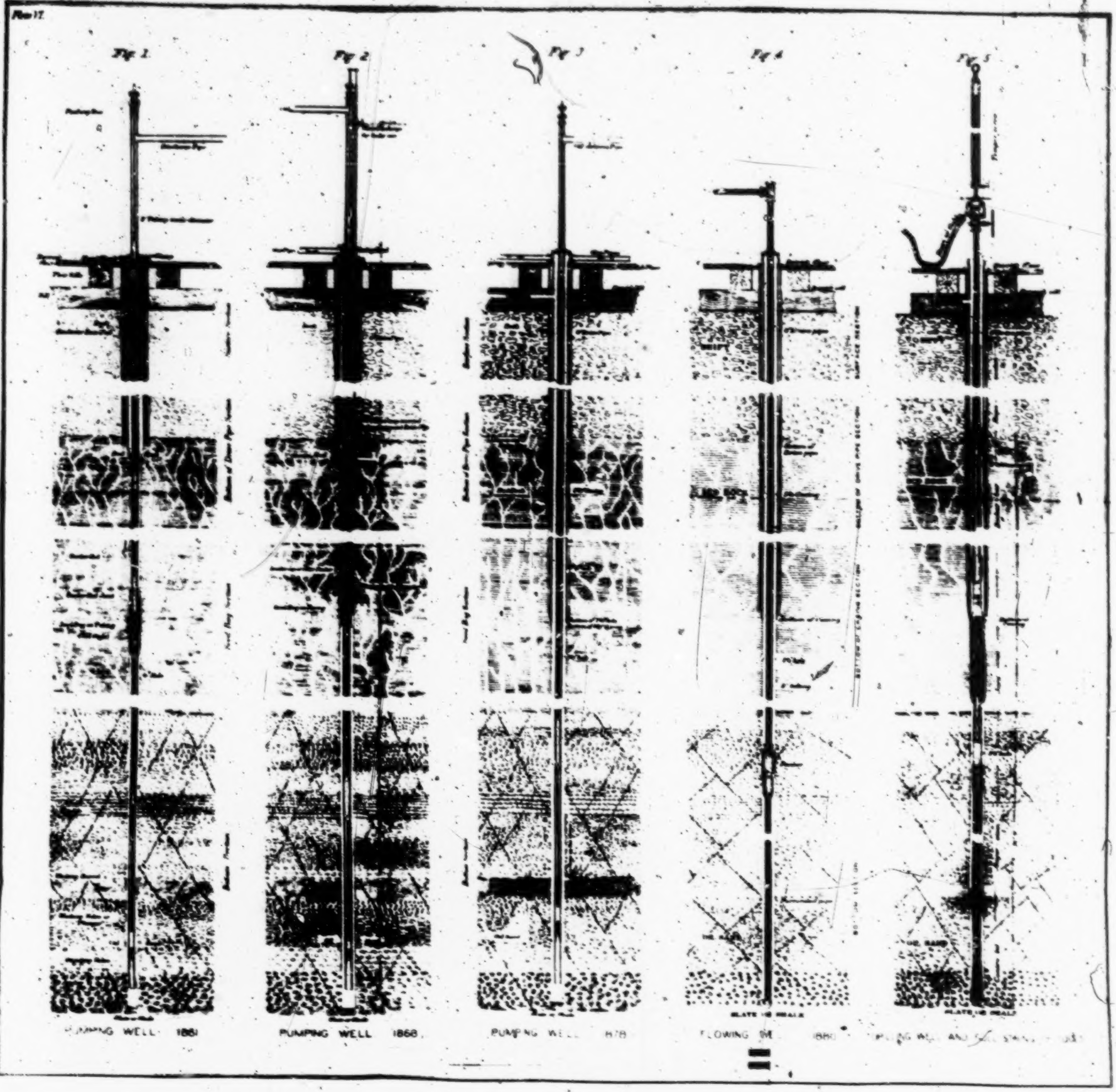


Fig 1
Fig 2
Fig 3
Fig 4
Fig 5
PUMPING WELL 1861
PUMPING WELL 1868
FLOWING

2. *Lateral leakage.*—In being forced up, the water will flow off sideways at its first opportunity. If, therefore, at any point in the upper portion of the well, it finds a crevice, or channel, or a porous bed, which is not occupied by water under as great pressure as itself, it will escape laterally, instead of forcing the column to the surface. It is necessary to prevent this lateral leakage. Sometimes the necessities of drilling lead to a satisfactory prevention. In sinking the well through the soil, sand, gravel, clay, or other loose material that may lie above the bed rock, it is customary to force down an iron tube, and sink it a few feet into the bed rock, by using a larger bit than that employed for the rest of the well. If a good joint is made here, and the rock below is tight, the lateral leakage may be thereby cut off, but this is not always available nor usually reliable. Besides, in many instances, the upper beds permit much waste, and recourse must be had to special methods for its control.

3. *Control of flow.*—It is clear, upon consideration, that perfect control may be obtained by putting down a tube to the densest portion of the upper confining bed, if, by some device, the space surrounding it may be closed up, so that no water can rise outside of the tube. Formerly, this was done by a very simple and ingenious device, known as the *seed-bag*. A long, stout, leather bag is made in the form of a cylinder, open at both ends, and just the size of the well bore. This is slipped on the lower end of the pipe, and the bottom of the bag securely fastened about the tube by wrapping with marline. A thimble just above the tie will aid in preventing slipping. It is then filled with dried flax-seed, and the upper end likewise closed around the tube. When thus adjusted it is lowered into the well to the point determined upon, and supported there until the seeds swell by absorbing water. This enlarges the bag so as to fit the bore tightly and shut off all water from rising outside the pipe, and so all is compelled to ascend through the tube to the surface, or, at least, as high as the pressure is competent to force it.

FIG. 25.—Seed-bag: *a*, delivery tube, leading to the surface of the well, and terminating below the seed-bag; *c*, a leather bag filled with dry flax-seed, *b*, marline wrappings to secure the end of the seed-bag.

A better and more convenient, but more expensive, packing takes advantage of the expansion of rubber disks when pressed together, instead of the swelling of flax-seed. A series of thick, washer-like rings

of rubber are fitted about a section of pipe, so adjusted between iron disks that, after being put down, they can be screwed together, and so caused to expand laterally, and completely fill the bore.

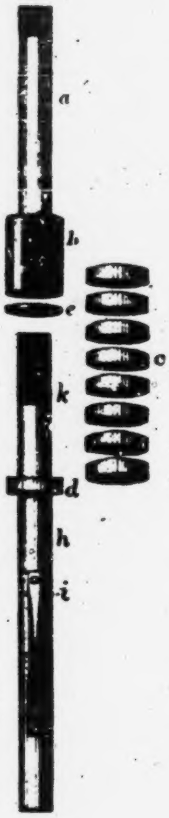


Fig. 26.

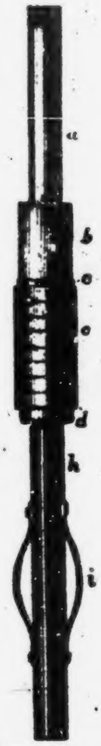


Fig. 27.

FIG. 26.—Rubber packing, shown apart; *a*, section of delivery tube, extending to the surface; *b*, a large thimble into which *k* screws; *e* an iron washer; *c*, a set of rubber disks, fitting on *k*, between *b* and *d*; *k*, a section of pipe on which is turned a long screw fitting in the thimble *b*; *d*, a disk forming the head of the screw *k*; *h*, a section of pipe extending about two feet below the packing; *i*, a spring to press against the walls and hold the pipe *h*, while the section *a* and thimble *b* are screwed upon *k*.

FIG. 27.—Rubber packing, shown screwed together as it is in the well.

The construction of the parts and their adjustment are sufficiently indicated in the accompanying figures, which illustrate one of the forms in use.

In a form employed in the oil regions, the expansion of the rubber disks, or single cylindrical one, is accomplished by pressing a conical hollow wedge between the pipe and the rings, thus forcing them out against the walls of the well.

In this case the packing is supported by a perforated tube, an "anchor," reaching to the bottom of the well. As the packing in artesian wells is often located near the top, the necessity for support from below excludes this form in most cases.[9]

[9] This form is described and figured by Mr. Carl, Second Geol. Surv. Penn., Rep. on Oil Regions, III, 1880, p. 322.

HEIGHT OF FLOW.

1. *Measurement.*—When the flow has been confined to the tube by either of the above devices, it is an easy matter to determine the available height to which it may be carried. Where the pressure is moderate, this is easiest determined by adding pipe above the surface until the water no longer rises through it. But when the pressure is great, it would ascend to an inconvenient height, and a pressure gauge of any available form may be substituted, and the height to which the water would rise, if suitably tubed, computed; each pound of pressure per square inch equaling 2.31 feet of rise.

2. *Prognostic estimate.*—The testing of the full strength of a generous fountain, already secured, is a comforting task, quite in contrast to the solicitude one suffers in attempting to estimate beforehand what height may be anticipated. Theoretically, the water will rise at the well to the same height as the fountain-head, and will flow at any elevation less than that. But the leakage of the confining strata and of the well reduce the height to which the water will rise, while the friction suffered in the long passage through the rock and the well will further lessen the altitude at which flow, of any notable vigor, will take place. Deduction must be made for all these elements. The special conditions which affect the estimate have been previously considered.[10] All the light that can be drawn from a careful scrutiny of these is demanded. The prudent expert will, however, seek assiduously a better and more truly scientific basis for his judgment. In almost every district wells have been attempted, and their results—whether successful or otherwise—if critically analyzed and interpreted, give valuable data, even though somewhat removed from the locality under consideration. The importance of recording and preserving the precise results of all enterprises, whether good or ill, cannot be too strongly urged upon drillers, geologists, and citizens alike, nor is it, perhaps, out of place here to urge that an intelligent respect be paid to the facts so developed; the respect, however, is no more important than the intelligence.

DETECTION OF FLOW.

It has been remarked above that the water may rise from the bottom to some higher portion of the well, and there find escape by passing off laterally through the upper strata. In the absence of control, the water does not always rise and overflow. It is a matter of some practical moment, therefore, to know when a stream is struck which may yield a flow at the surface when put under proper control. (1.)

[10] These conditions are so varied that I doubt the propriety of attempting any general statement of the deduction to be made from theoretical height. For Southern Wisconsin, I have found an allowance of about 1 foot for every mile between the collecting area and the site of the well to be as near a general estimate as I feel prepared to make; but even this is subject to considerable modification in special situations, and could not safely be adopted for other regions.

Such a stream usually discovers itself by a rise of water in the well, but this is not always the case. (2.) Some influence on the action of the drill is liable to be felt, which may arouse suspicion. (3.) In any instance of a strong flow, the drillings are apt to be carried away, so that when the sand-pump fails to bring these up, or brings only coarser material, there is good reason to believe that a stream has been struck, and the proper tests should be made. In enterprises that do not require a voluminous flow, tests should usually be made when such indications appear. It is ordinarily desirable to test the capacity of any stratum which gives any of these or other indications before sinking to a lower one. It is advisable to make provision in the contract for such tests, since it is not always to the interest of the driller, once his machinery is set up and well at work, to stop at the more limited depth. The capabilities of the flow may be tested by the use of a tube and seed-bag, or by rubber packing, as explained above.

Negative and false tests.—1. It is possible, in perfect honesty, to make both a negative and a false test. Suppose that two porous beds, A and B (Fig. 28), separated by an impervious layer, are traversed, and the testing of the first has been neglected, either because it failed to give encouraging indications or for other reasons. It is now desired to test these. Suppose the seed-bag or rubber packing be placed above the upper one. Now, if both bear a water-level equally high, the test will be fairly made, and the result will indicate their combined capacity; or, if both heads are at least as high as the surface at the well, the test may be accepted. But suppose that the bed A has been cut into by erosion, or been reached by crevices, or is otherwise defective, while the other, B, remains intact and bears an elevated fountain-head. Under these conditions the water may flow from B through the bore into A, and escape laterally through it, as illustrated in the figure. Now, in this case the result may be either simply negative or positively false and misleading. If the lateral leakage through the stratum A effectually disposed of the flow from B, and there was no leakage in the upper portion of the well, the water in the test-tube would stand during the test at essentially the same height as before, and the result would be negative, merely failing to indicate a possibility that really existed. If, on the other hand, there was lateral leakage through the upper strata as well as through A, neither alone being quite competent to dispose of the flow from B, then the introduction of the test pipe would cut off the upper leakage, leaving the bed A unable to dispose of the entire flow. In this case there would be a rise of water in the tube, and, possibly, a flow. The mischievousness of a test of this sort lies in the fact that it

FIG. 28.—Section of a well illustrating a negative test.

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appears to be a true test, because it shows some result, while in reality it is false and misleading. The true test in this case can only be made by placing the packing between the porous beds A and B.

2. Take another instance where two porous beds, as A and B, figure 29, have been traversed. Let the packing be placed between these. Then (1), if A equals B in productive capacity, water will stand at the same height within and without the test-pipe *if there is no leakage in the upper beds.* (2) If the failure to flow was due to such leakage, then a flow will result from B, but the additional flow which might be secured from A is lost (see figure). (3) If A has a greater head than B, and if there is no loss above, the water in the test-pipe will actually be lower than that outside, as illustrated in figure 30. This may be said to be an *inverted test,* and is less misleading than the false and negative tests, since it plainly indicates an error of manipulation. I have known such a case of reduced head as the result of an attempted test. (4) If, however, there is in this case considerable lateral waste in the upper strata, the valuable flow from A will be lost, just as before the test was made, while B may give a rise in the tube, or even a flow, which would foster the impression that a fair test had been made, while in reality the greater flow has been lost. (5) If A gives a feebler flow than B, but has an equal head, the test will fail of being completely satisfactory only in excluding the feebler flow from A. (6) If, however, A has a lower head, and is a possible means of escape for the flowage from B, then the packing has been placed at the right point, and the test gives the best results.

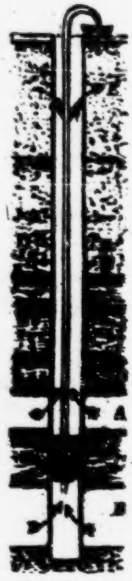


FIG. 29.—Section of a well showing a partial and misleading test.

3. In still another case let A and B represent porous beds (figure 31), the lower of which is so conditioned as to drain the upper one by virtue of a lower outcrop, in the manner previously explained and illustrated in figures 13 and 14. (1) First, if the drainage-loss below is not complete, and if the packing is placed above A, as shown in figure 31, I, the result will be negative, if there is no leakage in the upper strata. (2) Should there be considerable loss there it will be cut off by the tube and packing, and some rise in the tube will be the result in most cases. In either instance the result is misleading, particularly in the last, because the small

FIG. 30.—Section of a well illustrating an inverted test.

rise of the water is apt to allay any suspicion as to the effectiveness of the test. The real fact, however, remains that the flow from the productive stratum is mainly lost below. (3) Suppose that the packing is located between A and B, as in figure 31, II, it will then shut off the flow from A, while that in B, because of a lower outlet, will fail to flow. Now, if there is opportunity for lateral leakage in the upper strata the water from A will rise in the well *outside* of the test-pipe and pass off into these open upper beds. (4) But if no such opportunity is afforded it may rise to the surface and overflow *outside* of the test-pipe, while the water within the test-pipe will probably be found to be lower than

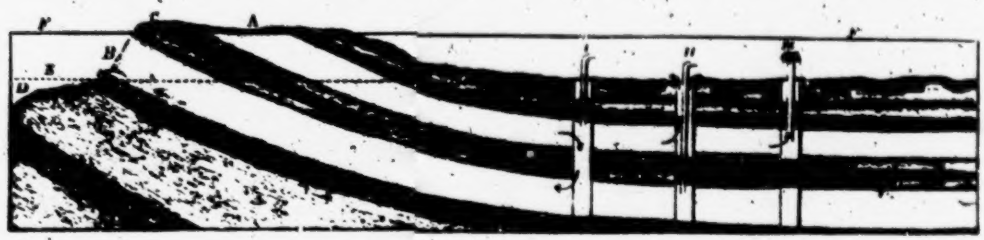


FIG. 31.—Section of strata and three wells, showing one correct and two erroneous tests. These wells are assumed to be independent of each other, and are placed together on the diagram merely for convenience.

before the test was made. The proper method of testing wells known or suspected to present these conditions is to sink a simple bag of seed or other obstruction to a point in the impervious stratum between A and B, which, when it tightens in its place, will shut off the flow below. Then a tube with packing sunk to a point above A will effectually cut off all leakage in the upper strata, and the full capacity of the water-bed A will be tested.

These examples, while not exhaustive of possible cases, illustrate the nature of defective tests and the deceptive conclusions liable to be drawn from them. The remedy is manifest. Test each water-bearing stratum as it is encountered, or else vary the final tests so as effectually to exclude all liabilities to error.

EFFECT OF TIME ON FLOW.

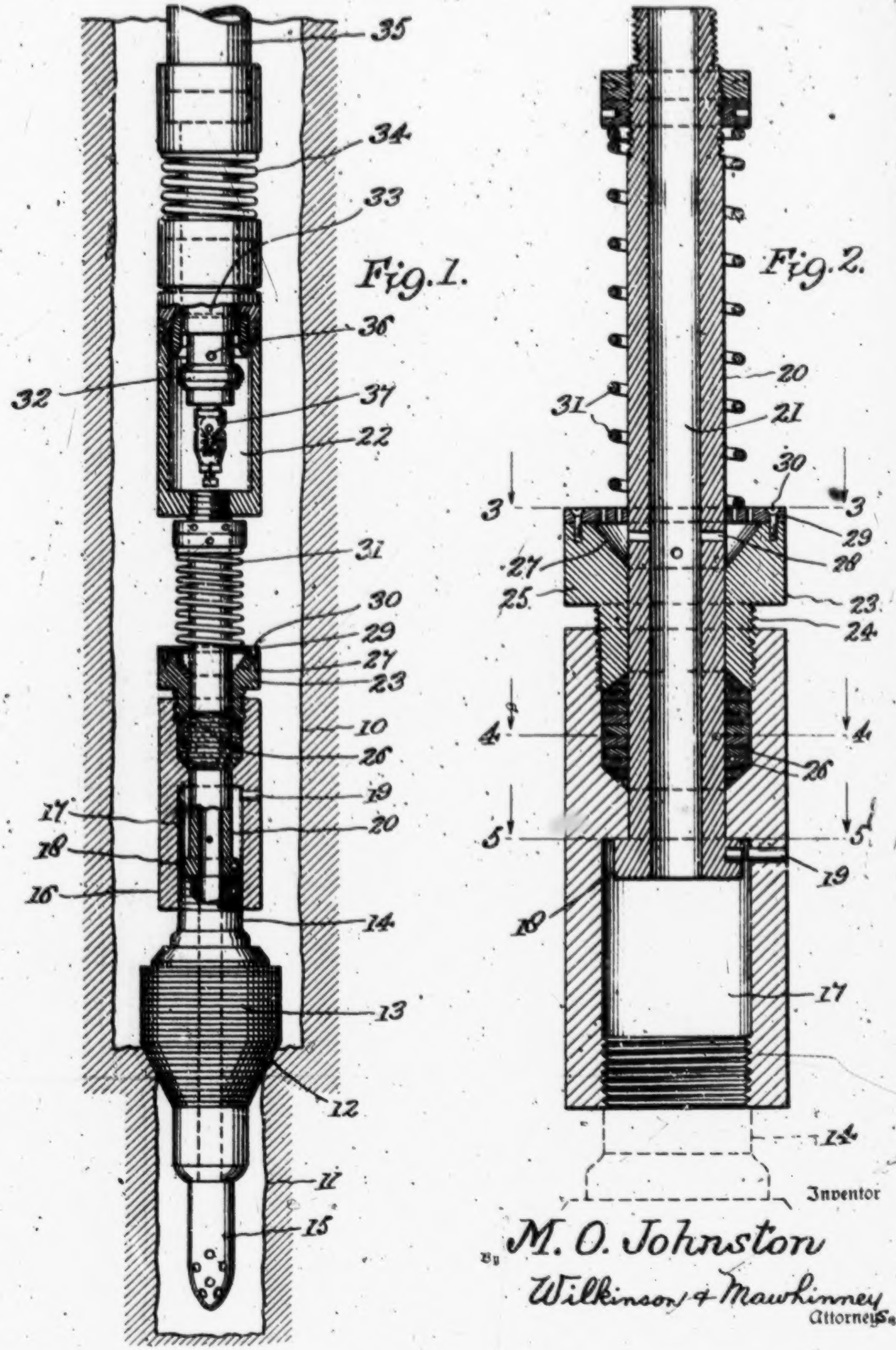
It is a common observation that the discharge of artesian wells declines in time, and the impression has somewhat obtained that this general fact is a necessary one. It is not unimportant, therefore, to consider the causes that lead to decline, since this is likely to be the best approach to the vital question, whether it is inevitable or preventable.

1. *Decline from loss of gaseous aid.*—We have thus far neglected a class of wells which flow, not from the pressure of an elevated fountain-head, but from the expansive force of pent-up gases, which are either disseminated throughout the water itself, like the carbonic acid in the soda fountain, or are contained in some hidden reservoir in communication with the water which is thus forced out. Wells of this class eject ing petroleum, gas, and water are familiar features of the oil regions.

March 14, 1933. M. O. JOHNSTON 1,901,813

OIL WELL TESTING DEVICE

Filed Sept. 7, 1932 2 Sheets-Sheet 1



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March 14, 1933. M. O. JOHNSTON 1,901,813

OIL WELL TESTING DEVICE

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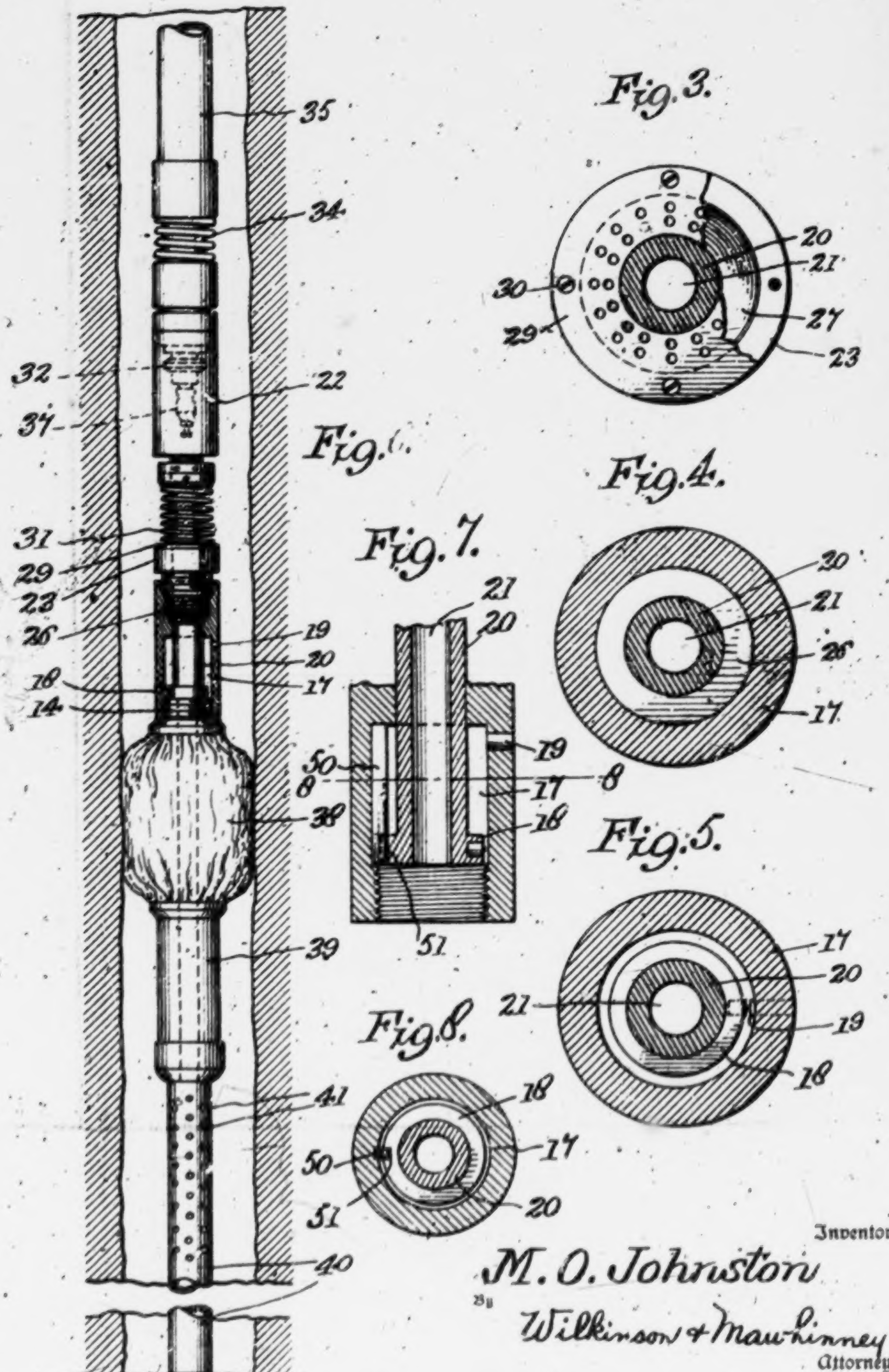

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UNITED STATES PATENT OFFICE

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OIL WELL TESTING DEVICE

Application filed September 7, 1932. Serial No. 632,048.

The present invention relates to improvements in oil well testing devices, and has for an object to provide an improved testing device which may be used in all methods of testing, whether below the casing in rat holes, straight holes or inside the casing itself at various depths where it is desirous to determine the oil or other liquid encountered, and bring the same through the drill pipe. Furthermore it is intended for use to determine the effectiveness of a cement job on water shut off.

My invention is especially intended to provide certain improvements on the construction shown in my Patent No. 1,842,270, granted January 19, 1932, and entitled Oil well testing device.

With the foregoing and other objects in view, the invention will be more fully described hereinafter and will be more particularly pointed out in the claim appended hereto.

In the drawings where like symbols refer to like or corresponding parts throughout the several views.

Figure 1 is a front elevational view with parts broken away showing a rat hole in the bottom of the well with my improved valve in lowered position and the other associated parts connected thereto.

Figure 2 is an enlarged central vertical section showing my improved valve in raised position.

Figure 3 is a horizontal section taken along the line 3—3 in Figure 2.

Figure 4 is a horizontal section taken along the line 4—4 in Figure 2.

Figure 5 is a horizontal section taken along the line 5—5 in Figure 2.

Figure 6 is a view showing my improved valve applicable for use with straight hole testing devices.

Figure 7 is a fragmentary central vertical section showing my improved valve in lowered position and engaging a key guideway affixed to the housing, and

Figure 8 is a horizontal section taken along the line 8—8 in Figure 7.

Referring more particularly to the drawings, I have shown in Figure 1 by the numeral 10 the walls of the well bore, and having a conventional illustration of a rat hole 11 in the bottom of the well. The upper edge of the rat hole 11 is preferably shouldered at 12 to provide a seat for the packer 13 which has its lower portion tapered to project downwardly into the rat hole 11. The packer 13 has the hollow mandrel 14 alined centrally and vertically therethrough to register with the bull plug 15 at its lower end, and to connect with the valve housing 16 at its upper end.

The valve housing 16 has its lower portion cut internally to form an elongated cylindrical chamber 17 to receive the piston head 18, and allow the same to slide freely therein. Referring more particularly to Figure 2, the head 18 is shown held in the upper portion of the chamber 17 by a shear pin 19, which engages the head 18 and is passed through the housing 16. The head 18 presents a flat upper surface to engage the top wall of the chamber 17 and likewise a flat lower surface to seat upon the mandrel 14 when the parts are operated as disclosed in Figure 1. The elongated sleeve 20 projecting upwardly from the head 18 and slidable therewith may be made integral or attached to the same. A central passageway 21 extending therethrough provides direct communication between the chamber 17 and the upper valve chamber 22.

The elongated sleeve 20 is held in proper alinement with the housing 16, and permits sliding movement of the same by the stuffing box 23, which comprises the lower reduced portion or neck 24, and the upper enlarged head portion 25. The neck 24 is screw threaded exteriorly to engage the threaded opening in the top of the housing 16, and compress the packing rings 26 below the same tightly around the sleeve 20. The head 25 is cut downwardly about the central portion of its top surface in an angular direction to form a circular recess as shown by the numeral 27. This provides a space to register with the ports 28, which are cut transversely through the sleeve 20 into and connect with the central passageway 21 when the piston head is in raised position. The

perforated plate 29 is readily secured on the top of the head 25, which forms a part of the stuffing box gland 23, by screws or other fastening means 30, and allows the sleeve 20 to slide freely therethrough.

The perforations in this plate 29 permit communication between the recess 27 and the well bore 10. It is obvious when the ports 28 are in raised position as shown in Figure 2, the perforated plate 29 will always allow the fluid or other liquids to pass therethrough in a straight, vertical path with the line of well boring 10. This perforated plate 29 also acts to exclude particles of dirt which might enter and tend to clog the ports 28 in the operation of the device.

A suitable coil spring 31 is properly adjusted between the plate 29 and the nuts 32 for normally holding the valve 18 and the elongated sleeve 20 in raised position. The chamber 22 as shown houses the trap valve 32 secured to the hollow stem 33 for vertical sliding movement, and as explained in my Patent No. 1,842,270 granted January 19, 1932, the trap valve is initially held seated in closed position by the coil spring 34 when the parts are attached to the well pipe 35 and the same are lowered into the well bore 10. The port holes 36 formed in the hollow stem 33 above the trap valve 32 are normally closed when the same is seated and are likewise opened with the valve 32 to give communication through the chamber 22 to the well pipe 35. Upon the lower end of the stem 33 is advantageously placed a circulating ball or other form of valve 37 that may be operated from the surface to force water through the pipe 35 to cleanse the interior parts in case mud or other foreign matter should cause these parts to become choked.

In Figure 6 I have shown my improved valve applicable where it is desirous to use the same with a device for straight hole testing. The numeral 38 represents a rubber sleeve expanding packer which can pass freely down the well bore 10 along with the other parts, but may be readily forced outwardly against the walls of the bore 10 when the desired depth is reached under the overhead weight of the well pipe 35.

This causes the lower portion of the well bore 10 below the packer 38 to be shut off and sealed from the upper portion. In order to make the test at the desired depth below the packer, a hollow sleeve 39 is attached to the lower portion of the projecting hollow mandrel 14 carried by the packer. The hollow sleeve 39 has secured thereto the elongated pipe or anchor 40 which is preferably of a reduced size in cross section, and extends to the bottom of the well bore 10. Suitable perforations 41 are made in the pipe 40 at the desired distance from the bottom of the well bore where it is desirous of making the test. The construction and arrangement of the parts above the packer are similar to those placed in the same position already described in Figure 1.

In the operation of the device and referring more particularly to Figures 1 to 5, the parts are readily attached to the well pipe 35, and then lowered into the well bore 10. The improved valve 19 during this initial step will be held in raised position as shown in Figure 2 and the trap valve 32 will be seated or in closed position. With the parts in this position the mud and fluid encountered will cause very little back pressure since the same can readily enter the perforated bull plug 15 and pass in a straight upward path through the valve and elongated sleeve 20.

The ports 28 provide outlets to the space directly beneath the plate 29, and the liquid is then passed upwardly through the perforations provided therein, to the well bore 10. It is readily appreciated the plate 29 with its small outlet perforations is advantageously placed to give protection to the ports 28 and prevent the same from becoming clogged from foreign matter that is encountered in well cavities.

When the device reaches the bottom of the well the parts will then assume the position for operation shown in Figure 1. Upon the entrance of the bull plug 15 into the rat hole 11, the packer 13 will rest or seat firmly upon the shoulder 12, at which time the weight of the well pipe 35 will compress spring 34 and force the trap valve 32 downwardly to open position. These parts will continue to move downwardly in this position, and because of their weight will break the shear pin [illegible] and release the piston head 18 whereby the same will be forced downwardly to seat on the hollow mandrel 14. Since the ports 28 are also moved downwardly they will become masked or closed by the packing [illegible]. The fluid or other liquid contents in the rat hole 11 upon entering the perforated bull plug 15 will be allowed to flow in a direct and vertical path into the chamber 22, and thence past the valve 32 through the port holes 36 into the well pipe 35.

Upon raising the pipe 35, it is obvious the trap valve 32 will be closed and prevent the escape of any fluid that has been entrapped above the same and may be brought to the surface as a sample for testing. Since the valve 18 will be lifted into raised position, the liquid in the well can readily enter the perforated plate 28 and escape through the bull plug, thus tending to ease the lifting of the device.

The placing of the ports 28 in the elongated sleeve 20 as shown, where they are not directly exposed at any time with the foreign matter encountered in wells and tending to clog or choke the same has provided greatly

to improved efficiency in a valve for making tests of this type.

Furthermore the present construction of valve housing provides for placing a packing 26 around the lower portion of the hollow sleeve 20, and thus gives a tight and more successful means of preventing the escape of the fluid passing therethrough or the intrusion of foreign matter from this point when the parts become slightly worn after operating a long time.

In Figure 6, where the parts are assembled for straight hole testing, an expanding packer 38 is used which initially will be of a size to slide freely down into the well bore 10. Assuming the trap valve 32 closed and the improved valve 18 in raised position, the packer 38 carrying the pipe or anchor 40 is attached to the well pipe 35, and lowered into the well bore 10.

The mud and fluid will be allowed to pass through the pipe 40, and out the perforations in the plate 29, and thus relieve or retard any backward pressure encountered. When the pipe or anchor 40 rests upon the bottom of the well, the weight of the well pipe 35 will force the opening of the trap valve, and then in turn close the valve 18. During this action the overhead weight pressing downwardly upon the packer 38 will necessarily cause the same to expand or bulge outwardly against the walls of the well, and thus seal the lower portion of the same. The fluid entrapped below the packer and at a height from the bottom of the well to register with the perforations 41 will thus be enabled to pass upwardly into the well pipe as previously described.

I have shown in Figures 7 and 8 means whereby I may facilitate the proper placing of the valve 18 for the ready insertion of the shear pin 19 when the valve is in raised position. This construction also permits the rotation of the entire tool, whenever desired. This always is necessary when using casing-packer method of testing inside casing that drill pipe may be turned to disengage slips that anchor packer to side walls of casing. It also often is necessary to rotate entire tool in our straight-hole and rat-hole methods of testing.

In accomplishing this feature a key 50 is affixed to the interior wall of the chamber 17 and forms a vertical guideway. The valve head 18 is provided with a notch or groove 51 to engage the key. Thus the valve head is restricted to move over the same path in either an upward or downward direction as may be desired in the proper positioning of the valve.

This valve construction can be readily applied to various types of testing tools now used and attain the satisfactory and highly efficient results as already described.

It will be noted that the device is useful not only in open-hole testing and in shoulder testing, but also in casing-packer testing.

What we wish to cover is the use of valve in all methods of testing whether below casing in rat-hole or straight-hole or inside the casing itself.

It is obvious that various changes in the construction, combination and arrangement of parts could be made, which could be used without departing from the spirit of my invention, and I do not mean to limit the invention to such details, except as particularly pointed out in the claim.

Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States is:—

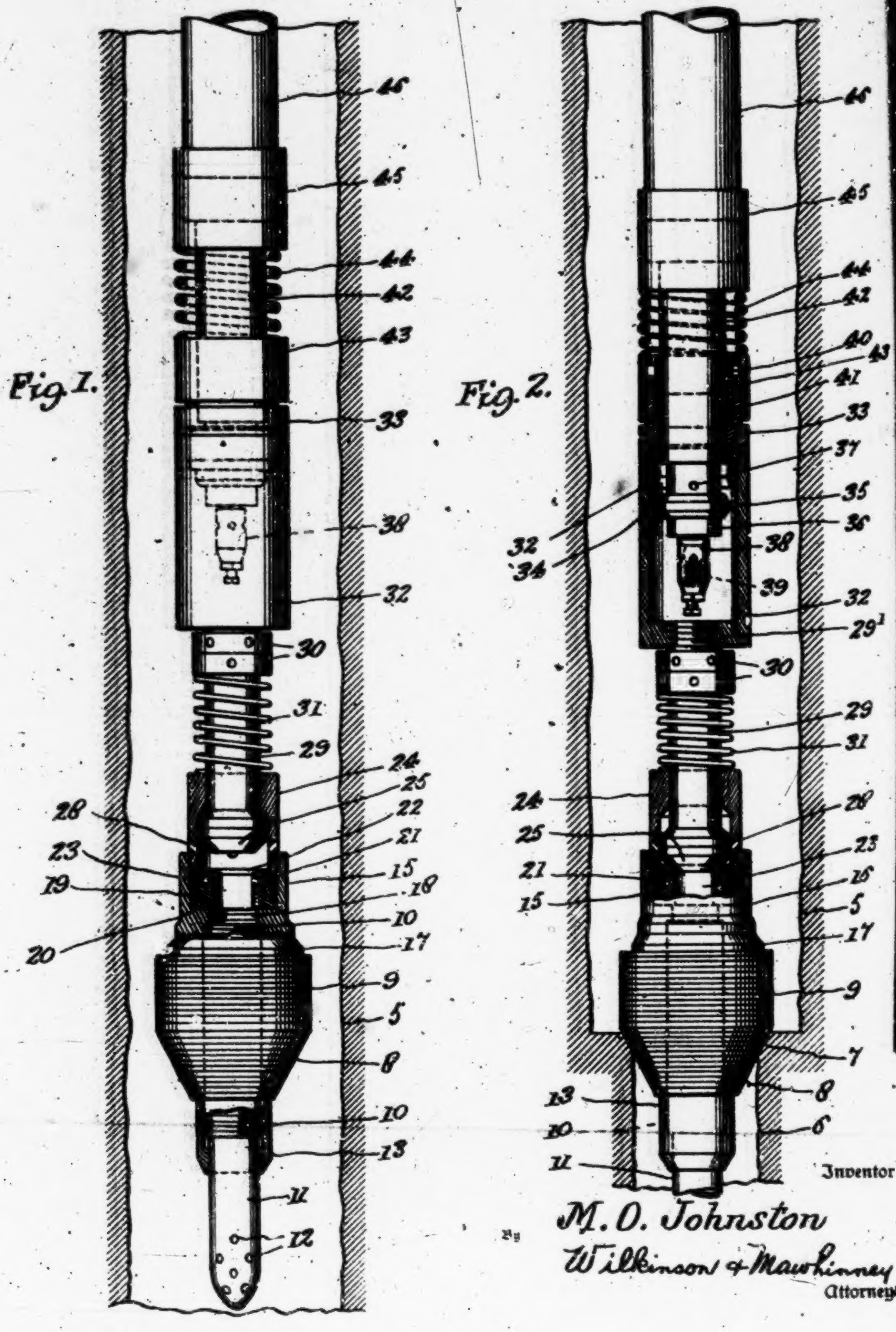
In a well testing device provided with a packer, adapted to be used in a well cavity, a valve housing rigidly attached above the packer, a valve comprising a piston head and an elongated sleeve having a central passageway therethrough mounted to slide in the housing, open ports cut through the elongated sleeve to connect with the central passageway, a packing carried in said housing to encase the lower portion of the elongated sleeve, and mask said ports when the piston head is moved downwardly, a compression gland secured to said housing whereby to compress the packing and permit movement of the elongated sleeve, the said gland having a recess cut therein to register with the ports when the piston head is moved upwardly, a perforated plate secured to the top of the gland whereby to permit communication between the recess and the well cavity and allow movement of the sleeve therethrough, and means for engaging the perforated plate and said elongated sleeve to return the piston head to raised position.

MORDICA O. JOHNSTON.

Jan. 19, 1932.　　M. O. JOHNSTON　　1,842,270

OIL WELL TESTING DEVICE

Filed June 19, 1931　　2 Sheets-Sheet 1



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Jan. 19, 1932. M. O. JOHNSTON 1,842,270

OIL WELL TESTING DEVICE

Filed June 19, 1931 2 Sheets-Sheet 2

Fig. 3.

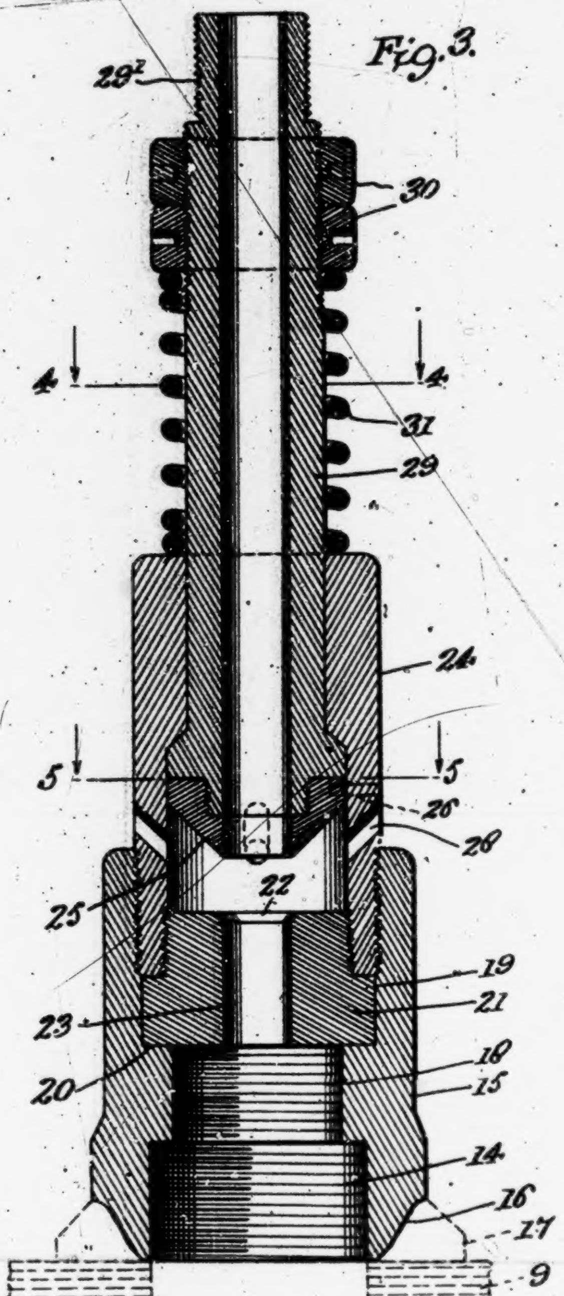


Fig. 4.

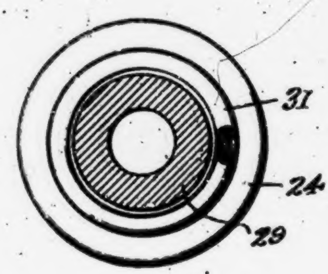


Fig. 5.

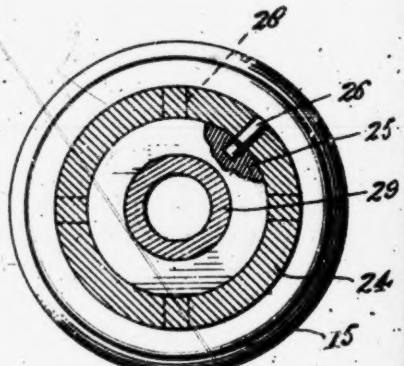
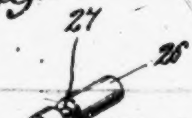


Fig. 6.



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Patented Jan. 19, 1932 1,842,270

UNITED STATES PATENT OFFICE

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OIL WELL TESTING DEVICE

Application filed June 19, 1931. Serial No. 545,576.

The present invention relates to improvements in well testing devices, and has for an object to provide an improved testing device in which samples of oil, or other liquid, may be taken from the bottom of the well and brought up through the drill pipe.

It is an object of the present invention to provide a device that can be more readily released after the packer has reached the rathole, and the test completed without putting the lifting strain on the drill pipe by placing above the packer a valve that can be moved in its housing to expose ports and thus allow the free flow of mud from the well cavity above the packer through the ports into the device and out the bull plug whereby to equalize pressure.

Another object of the invention is to provide a device which can be easily inserted into a well cavity where the packer more nearly approaches the size of the hole by keeping the valve in raised position where it will allow the ports in the valve housing to remain open, and thus permit the fluid to more readily pass through the device from below the packer and thence out the ports above the same.

A further object of the invention resides in a device that will permit the packer to be washed free when the same may become stuck by allowing the valve to remain open and water pumped under pressure through the drill pipe past the valve and out the ports on to the top of the packer.

It is still a further object of the invention to provide a device where the valve parts can be made to produce a jarring action when desirable to loosen the packer from its seat.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claims appended hereto.

In the drawings where like symbols refer to like or corresponding parts throughout the several views,

Figure 1 is a front elevational view with parts broken away of my well testing device with my improved valve in raised position.

Figure 2 is a similar view showing my improved valve in lowered position.

Figure 3 is an enlarged central vertical sectional view of my improved valve in raised position.

Figure 4 is a horizontal section taken along the line 4—4 in Figure 3.

Figure 5 is a horizontal section taken along the line 5—5 in Figure 3, and

Figure 6 is a perspective view of one form of shearing pin to hold the valve in raised position.

Referring more particularly to the drawings, the numeral 5 indicates the well generally, and 6 is a conventional showing of a rathole in the bottom of the well, resulting in the shoulder 7 against which the lower bevel portion 8 of the packer 9 is adapted to engage. The packer extends exteriorly of the packer mandrel 10, the lower end of which carries the bull plug 11 provided with the perforations 12 through which the liquid can pass. The lower portion of the packer mandrel is screw threaded to receive the retaining nut 13 which extends up against the lower portion of the packer whereby to hold these parts in fixed relation. The upper portion of the packer mandrel projects beyond the top of the packer and is screw threaded along its upper outside portion to engage corresponding threads cut in the lower inside opening 14 of the head 15 whereby these members are held firmly together in alignment.

The head 15 comprises substantially a hollow cylinder of outside uniform diameter over its greater length with a lower enlarged portion cut inwardly at an angle 16 to seat and hold the ring 17 cut at a corresponding angle to engage the lower portion of the head and also provide a flat base to rest upon the top ring of the packer whereby the packer rings can be properly clamped together when the retaining nut 13 is screwed tight. The head is provided with a smaller screw threaded opening 16 in alignment with the screw threaded opening 14 and terminating at a point preferably midway of the inside of the head to allow for the insertion of tools of a lesser diameter.

The upper cylindrical portion of the head is bored to form an opening 19 of greater diameter than the opening 18 and extended down to a point to communicate with the smaller opening, thereby producing a shoulder 20 to engage and house the ring 21 formed with the valve seat 22 terminating in the central opening 23 and having an outer portion cut away and screw threaded to receive the lower inside screw threaded end of the valve housing 24.

The opening 19 in the head is also screw threaded to receive the screw threads on the lower outer portion of the valve housing and thereby hold these parts rigid. The valve housing is internally bored to provide a chamber wherein the valve 25 is normally held in the upper position shown in Figure 1 by a pin 26 with the weakened portion 27 being inserted through the wall of the valve housing and into a socket in the valve. It is to be understood any form of frangible pin may be used and I do not mean to limit myself to any particular design of such pins. The valve in this position is spaced from its valve seat 22 and also exposes the downwardly inclined outlets 28 in the valve housing, thereby allowing mud or fluid to pass from the well cavity through the outlets, down the central opening in the ring 21 and thence seek outlet through the perforated bull plug.

The valve 25 is bored centrally to provide a passageway and register with the elongated opening in the hollow valve stem 29 that has its lower end externally screw threaded to engage the internal screw threaded portion of the valve, thereby holding the valve and valve stem together. The valve stem passes through the valve housing and extends upward beyond the same and carries the adjusting nuts 30 to engage the screw threaded portion closely placed to the upper end of the valve stem. A coil spring 31 is mounted upon the valve stem with its lower end engaging the top of the valve housing, and with its upper end in contact with the adjusting nut 30, whereby to normally hold the spring in expanded position and the valve in raised position disclosed in Figure 1 and Figure 3.

The end 29' of the valve stem is reduced slightly in size and screw threaded to firmly secure thereto the valve chamber 32 having its upper end internally threaded to engage the exterior threads on the stuffing box section 33. Within the stuffing box section is secured a section providing a trap valve seat 34 to engage the trap valve 35 secured to the hollow valve stem 36. The valve stem is provided with a series of radially extending ports 37 which lie above the valve and extend completely through the valve stem 36. Carried upon the lower end of the valve stem is a circulating ball or other form of valve 38 held against its seat upon the lower end of the valve stem by a spring 39.

The upper end of the stuffing box section 33 is interiorly screw threaded to receive the packing gland 40 to compress the gland 41 against the travelling stem 42. The lower end of the travelling stem carries the trap valve stem 36. The stuffing box section is also exteriorly threaded to receive the tension collar 43 which receives the lower end of the main spring 44. The upper end of the main spring seats against the lower end of the reducing collar 45, which latter supports the upper end of the travelling stem 42, the upper end of the travelling stem being screw threaded into the collar 45 or otherwise held firmly.

The pipe line 46 is screwed or otherwise rigidly held in the collar 45.

In the operation of the device, the parts are assembled and lowered into the well cavity, as shown in Figure 1, with my improved valve in the raised position exposing the outlet openings 28 in the valve housing 24 and while so placed, the trap valve 35 and circulating valve 38 are closed. Where the well cavity closely approaches the size of the packer and mud or fluid are encountered, the lowering of the device will be greatly improved from back pressure caused by mud or fluid below the packer since they can pass into the perforated bull plug 11, through the mandrel 10 into the valve housing 24 and escape through the outlets 28 placed above the packer communicating with the well cavity 5.

When the device reaches the bottom of the well, the parts assume the position shown in Figure 2. The bull plug enters the rathole and the packer 9 will seat upon the shoulder 7, at which time the weight of the drill pipe 46 compresses the spring 44 and opens the trap valve 35 in the valve casing 32. These parts will continue to move downward in this position since their weight will cause the shearing of the pin 26, whereby to release the valve 25 compress the spring 31 and force the same down on its seat 22. In the lowered position, the valve 25 closes the outlets 28 communicating with the well cavity and with the parts so positioned the fluid to be sampled can enter the bull plug 11, and be carried past the valve 25 through the trap valve 35 and thence through the drill pipe.

The valve 25 and its housing 24 having outlets 28 are located above the packer 9 and below the valve chamber 32 in which is housed the trap valve 35 and circulating valve 38. The location of the parts in this position aids in the lowering of the improved device into a well cavity since the mud and fluid below the packer that cause back pressure upon the same can readily pass into the bull plug 11, below the packer, and thence through the outlets 28 above the

packer into the well cavity and thus afford a means of equalizing the pressure.

It will allow the valve 25, when the device has reached the bottom of the well and the packer 9 has seated, to close the outlets 28 and open the trap va.ve 35 whereby the fluid sealed in the rathole 6 can be carried up through the trap valve without interference from the fluid or mud contained in the well cavity 5.

A feature of the invention is that the valve 25 when in the raised position to expose the outlets 28 and the packer becomes stuck, it will allow water under pressure to be forced down the drill pipe 46 through the circulating valve 38 and thence through the outlets 28 on to the top of the packer, whereby to wash the same free and allow free movement.

A further feature of the invention is the location of the spring 31 upon the valve stem 29 above the valve housing 24 to return the valve 25 immediately to raised position when the weight of the drill pipe has been removed in lifting. This action closes the trap valve 35 to retain the sample fluid carried up past the same and also opens the outlets 28, thereby allowing the mud to pass therethrough and out the bull plug into the rathole and thus prevent lifting strain to be put upon the device.

With the valve 25 and the other parts of the device arranged as shown, it will be possible to jar the packer loose when struck by a slight raising and releasing of the drill pipe.

While I have shown the lower end of the valve housing 24 adapted to screw inside of the head 15, it may be preferable to reverse this form of connecting these parts and permit the valve head 24 to screw outside the head 15. It is also to be noted that while I have shown my improved valve as applied to but a single type of well testing devices, it is obvious I may readily attach and use the same with any type of testing devices.

It is obvious that various changes in the construction, combination and arrangement of parts conld be made, which could be used without departing from the spirit of my invention, and I do not mean to limit the invention to such details, except as particularly pointed out in the claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States is:—

1. In a well testing device provided with a packer adapted to be used in a well cavity, a valve housing rigidly mounted above the packer with outlets communicating with the well cavity, and a movable valve carried in the housing whereby to open and close said outlets.

2. In a well testing device provided with a packer adapted to be used in a well cavity, a valve housing rigidly mounted above the packer with outlets communicating with the well cavity, a valve normally held in the housing to expose the outlets therein to communicate with the well cavity, and means for releasing said valve to move and close said outlets.

3. In a well testing device provided with a packer adapted to be used in a well cavity, a valve housing rigidly mounted above the packer with outlets communicating with the well cavity, a valve seat provided with an opening fixed in the lower end of the housing to form a central passageway, a valve normally held spaced from the valve seat to expose the central passageway and the outlets communicating with the well cavity, and means for releasing said valve whereby to move and close said outlets.

4. In a well testing device provided with a packer to be used in a well cavity, a valve housing rigidly mounted above the packer with outlets communicating with the well cavity, a valve seat with a central opening fixed in the housing, a valve provided with a travelling stem, normally held spaced from the valve seat to expose the outlets communicating with the well cavity, means for releasing the valve and travelling stem whereby to close the communicating outlets, and a spring carried by the travelling stem positioned to be compressed when the valve is closed and to restore the parts to normal position when the release means are removed.

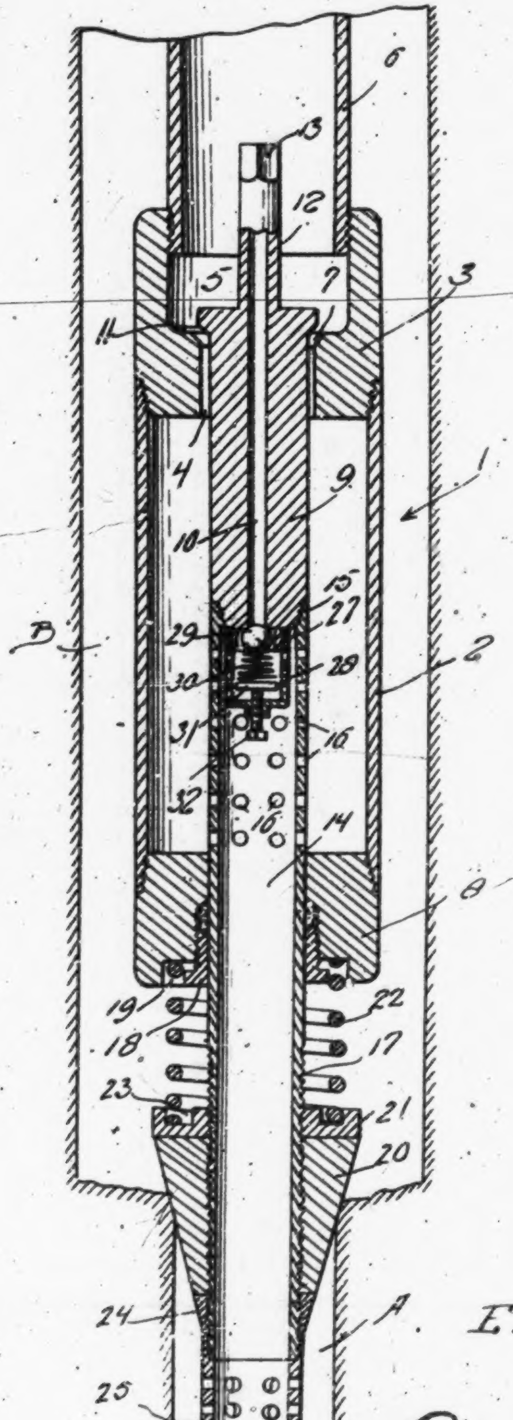
5. In a well testing device provided with a packer to be used in a well cavity, a mandrel to support the packer, a valve housing above the packer having a valve seat mounted therein and provided with outlets to the well cavity, a substantially cylindrical head for engaging the mandrel and the valve housing whereby to hold these parts in fixed relation a valve seat fixed in the housing, a valve with a travelling stem normally held spaced from the valve seat to expose the outlets communicating with the well cavity, a second valve housing carried by the drill pipe and attached to the travelling stem, the valve and travelling stem positioned to receive the weight of the drill pipe and close the communicating outlets, and a spring carried on the travelling stem positioned to be compressed when the valve is closed and for returning the valve to normal position when the drill pipe is raised.

MORDICA O. JOHNSTON.

23, 1929. E. C. JOHNSTON 1,709,940

WELL FORMATION TESTING DEVICE

Filed March 23, 1927



Inventor

E. C. Johnston,

By Clarence A. O'Brien

Attorney

Patented Apr. 23, 1929. 1,709,940

UNITED STATES PATENT OFFICE.

EDGAR CLINTON JOHNSTON, OF EL DORADO, ARKANSAS, ASSIGNOR TO JOHNSTON FORMATION TESTING CORPORATION, OF EL DORADO, ARKANSAS, A CORPORATION OF DELAWARE.

WELL-FORMATION-TESTING DEVICE.

Application filed March 23, 1927. Serial No. 177,719.

The present invention relates to improvements in testing devices for use in connection with formation and drilling oil wells and the like and has for its principal object to provide a simple and efficient means for accurately testing sands which are encountered during the drilling of the well.

One of the salient objects of the present invention is to provide a testing device of the above mentioned character which includes an automatically operated valve structure, which will at all times be positive and efficient in its operation.

In drilling a well where a likely formation is struck, the operator of the drilling mechanism or apparatus will reduce the size of the hole that is being drilled by the method commonly known or called "rat holing". This rat hole is formed by employing a bit of a smaller size than the one used to finish the hole.

One of the important objects of the present invention resides in the provision of a testing device, which may be readily and easily secured on the lower end of the drill pipe, the testing device including a perforated plug which is adapted to enter the rat hole, in order to permit any fluid or gas to enter the tester. A tapered packer is associated with the tester at a point above the perforated plug and this packer is adapted for cooperation with the upper portion of the rat hole for the purpose of preventing water and mud laden fluid from entering the rat hole and subsequently the perforated plug. Means are further associated with the tester for permitting the fluid to pass upwardly therethrough and enter the drilling pipe. A normally closed valve is arranged within the testing device, the same being opened by the weight of the tester and the pipe to which the device is attached, when the packer strikes the rat hole.

A further object of the invention is to provide an emergency relief arrangement by means of which, should the testing device become stuck in any part of the well bore, as by the crumbling in of the walls of the well, fluid pressure may be supplied below the tester, tending to facilitate the withdrawal upward of the drill tube and tester, without necessitating troublesome, expensive and often futile fishing operations.

A further object is to provide a device of the above mentioned character which is simple in construction, inexpensive, strong and durable and further well adapted to the purposes for which it is designed.

Other objects and advantages will become apparent during the course of the following description.

In the accompanying drawing, forming a part of this specification, and in which like numerals indicate like parts throughout the same:

The figure represents a vertical sectional view through the testing device embodying my invention, and showing the same in actual use, the valve being open.

In the drawing wherein for the purpose of illustration is shown the preferred embodiment of my invention, the numeral 1 designates generally the tester. The same comprises the cylindrical casing 2 which is internally threaded at its upper and lower ends. A bushing or fitting 3 is threaded at its lower end in the upper internally threaded end of the cylindrical casing 2 and the upper portion of the bushing has the bore 4 thereof enlarged to provide the socket 5. This socket is internally threaded at its upper end whereby the bushing or head may be threaded on the lower threaded end of the drill pipe 6. The valve seat 7 is formed at the juncture of the bushing 3 with the socket 5, and the purpose of this valve seat will be hereinafter more fully described.

A bushing or head 8 is threaded at its upper end in the lower internally threaded end of the cylindrical casing 2, thereby providing a unitary structure between the casing and the heads.

My improved tester further includes the provision of the stem 9, which is of a diameter slightly less than the diameter of the bore 4 of the bushing 3, and through which the stem extends. This stem is formed with a longitudinal bore 10. A valve 11 is formed at the upper end of the stem and is arranged within the socket 5 for cooperation with the valve seat 7. This valve is normally maintained in a closed position against the valve

seat by a suitable spring in the manner to be presently apparent. A tubular extension 12 is formed on the upper end of this stem 9 and this extension extends upwardly into the lower end of the pipe 6 as is shown in the drawing. The upper end of the extension is formed with a square shoulder 13 whereby the stem may be rotated for engagement with or disengagement from the pipe 14.

This pipe 14 extends through the bore of the lower bushing 8 and the upper portion of the pipe extends into the cylindrical casing 2 and is internally threaded at its upper end for detachable engagement with the lower threaded end of the stem 9. The connection 15 between the lower end of the stem 9 and the upper end of the pipe 14 will form a unitary structure.

The upper portion of this pipe is formed with a series of fluid outlet openings 16, and the lower end of this vertical pipe 14 is externally threaded as is clearly shown at 17 in the drawing.

A suitable packing gland 18 is threaded upwardly into the bore of the lower bushing 8 and the same surrounds the intermediate portion of the pipe 14. The bottom of the bushing 8 is formed with an enlarged cut out portion 19 to receive the tool engaging end of the gland 18.

A tapered rubber packer 20 is formed with a central bore and is adapted for disposition upon the lower threaded end of the pipe 14. A relatively thick plate formed with a central threaded opening is threaded on the threaded end portion 17 of the pipe 14 and engages the top of the tapered rubber packer 20 in the manner clearly shown in the drawing and this plate is designated by the numeral 21. A heavy expansible coil spring 22 encircles the threaded portion 17 of the pipe 14 and is disposed between the bushing 8 and the plate 21. The upper end of the spring encircles the tool engaging end of the packing gland 18 and is disposed within the cut out portion 19 formed in the bottom of the bushing 8. The lower end of this spring is disposed within an annular groove 23 formed in the top of the thick plate 21. The expansible spring 22 normally urges the casing 2 and the bushings carried thereby upwardly so that the seat 7 will be held against the valve 11, thus cutting off communication between the socket 5 and the cylindrical casing 2 as is readily obvious from the construction shown in the drawing.

A tapered collar 24 is formed with a central threaded bore for threaded engagement on the threaded end of the pipe 14 and the lower end of the tapered rubber packer 20 engages the upper face of this downwardly tapered collar and the collar provides means for preventing any possibility of the rubber packer 20 working downwardly on the lower end of the pipe 14.

Adapted for cooperation with the lower end of the pipe 14 is the perforated hollow plug 25, the lower end thereof being closed. However, the closed lower end of the hollow plug is also formed with a series of perforations or openings similar to the openings formed in the side of the plug, and these openings are shown at 26. The perforated plug is threaded on the lower threaded end 17 of the pipe 14 and the upper open end of the plug will engage the lower end of the downwardly tapered collar 24 in the manner as clearly shown in the drawing. A reduced externally threaded neck portion 27 is formed on the lower end of the stem 9, the same surrounding the bore 10. A cage 28 open at its upper end is threaded on this depending neck 27 and is arranged within the upper portion of the pipe 14. Confined within the cage 28 and adapted for cooperation with the lower end of the bore 10 formed in the stem 9 is the ball valve 29. An expansible spring 30 normally urges the ball valve 29 against the lower end of the bore 10 for closing the same and the tension of this coil spring is adjusted through the medium of a plate 31 slidable within the cage 28 and a bolt 32 is threaded through the bottom of the cage and engages the slidable plate 31 in the manner as clearly shown in the drawing.

The ball valve 29 will normally prevent any possibility of any fluid passing upwardly through the stem 9. The operation of my improved testing device may be briefly stated as follows:

After the rat hole A has been formed, the testing device is attached to the lower end of the drill pipe 6 and the same is lowered within the larger hole B, so that the lower end of the pipe 14 will enter the rat hole and the hollow perforated plug 25 will be enclosed therein. The tapered rubber packer 20 will engage the upper edge of the rat hole and thereby form a closure for preventing any possibility of water or mud laden fluid from entering the rat hole from above. Due to the weight of the cylindrical casing and its bushings as well as the drill pipe 6 to which the casing is secured, the latter will move downwardly on the pipe 14, against the tension of the coil spring 22, thus removing the valve seat from engagement with the valve and the fluid which enters the pipe 14 through the holes 26 in the perforated plug 25 will pass upwardly through the pipe and be discharged into the casing through the outlet openings 16. The fluid will then pass upwardly through the bore 4 around the stem 9 and will further pass outwardly through the drill pipe 6.

In using the present device, it may be found necessary to circulate the mud laden fluid in the hole B and to this end, the fluid is admitted through the tubular extension

12 formed on the stem 9 and the pressure of this fluid will unseat the valve 29 and the fluid will then pass downwardly through the pipe 14 into the perforated plug 25 and will then circulate upwardly around the tester. Thus, should the tester stick in the well at any part of the bore above the rat hole, caused for instance by the crumbling in of the side walls of the well, fluid under pressure may be pumped into the well below the tester, and an upward pressure created which would greately facilitate the lifting of the tester and the drill pipe attached thereto upwards to the surface, or as far up as may be desired.

When the device is in its lowermost position, the valve is open and manifestly when the device is lifted upwardly, the valve will be automatically moved to a closed position. The provision of a valve structure of this character will obviate the necessity of having to provide any additional means for actuating the valve such as is employed with certain types of testing devices now in use. With a testing device of the above mentioned character, the various formations encountered in drilling operations may be tested in a simple and efficient manner. The simplicity with which my device is constructed enables the parts to be readily and easily assembled and attached to the lower end of a drill pipe, and the device will at all times be positive and efficient in carrying out the purposes for which it is designed.

While I have shown the preferred embodiment of my invention, it is to be understood that various changes in the size, shape and arrangement of parts may be resorted to without departing from the spirit of the invention and the scope of the appended claims.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:—

1. Apparatus for testing formations in oil wells, in which the well is provided with the usual bore and rat hole, comprising a drill tube projecting down into the well, a hollow cylindrical casing attached to the lower end of said drill tube, the upper head of said casing being provided with a valve seat and a bore beneath the same, and the lower head of said casing being provided with a stuffing box, a hollow valve stem carrying a valve, slidably mounted in said bore, a tube connected to the lower end of said valve stem and provided at its upper end with a series of perforations, said tube projecting down through said stuffing box, a perforated plug secured to the lower end of said tube and adapted to project down into the rat hole of the well, a packer mounted on said tube above said plug, a coil spring held under compression between said casing and said packer and normally adapted to hold said valve on its seat, and a spring impressed emergency valve located within said tube and normally closing the passage through said valve stem, but yielding to fluid pressure from above.

2. Apparatus for testing formations in oil wells, in which the well is provided with the usual bore and rat hole, comprising a drill tube projecting down into the well, a hollow cylindrical casing attached to the lower end of said drill tube, the upper head of said casing being provided with a valve seat and a bore beneath the same, and the lower head of said casing being provided with a stuffing box, a hollow valve stem carrying a valve, slidably mounted in said bore, a tube connected to the lower end of said valve stem and provided at its upper end with a series of perforations and at its lower end with external threads, said tube projecting down through said stuffing box, a perforated plug screwed on to the lower end of said tube and adapted to project down into the rat hole of the well, a tapered packer mounted on said tube above said plug, and adapted to engage in the upper portion of said rat hole, a coil spring held under compression between said casing and said packer and normally adapted to hold said valve on its seat, and a spring impressed emergency valve located within said tube and normally closing the passage through said valve stem, but yielding to fluid pressure from above.

3. Apparatus for testing formation in oil wells, in which the well is provided with the usual bore and rat hole, comprising a drill tube projecting down into the well, a hollow cylindrical casing attached to the lower end of said drill tube, the upper head of said casing being provided with a valve seat and a bore beneath the same, and the lower head of said casing being provided with a stuffing box, a hollow valve stem carrying a valve slidably mounted in said bore, a tube connected to the lower end of said valve stem and provided at its upper end with a series of perforations, said tube projecting down through said stuffing box, a perforated plug secured to the lower end of said tube and adapted to project down into the rat hole of the well, a packer mounted on said tube above said plug, and a coil spring held under compression between said casing and said packer and normally adapted to hold said valve on its seat.

4. Apparatus for testing formation in oil wells, in which the well is provided with the usual bore and rat hole, comprising a drill tube projecting down into the well, a hollow cylindrical casing attached to the lower end of said drill tube, the upper head of said casing being provided with a valve seat and a bore beneath the same, and the lower head of said casing being provided with a stuffing box, a hollow valve stem carrying a valve

slidably mounted in said bore, a tube connected to the lower end of said valve stem and provided at its upper end with a series of perforations and at its lower end with external threads, said tube projecting down through said stuffing box, a perforated plug screwed to the lower end of said tube and adapted to project down into the rat hole of the well, a tapered packer mounted on said tube above said plug, and a coil spring held under compression between said casing and said packer and normally adapted to hold said valve on its seat.

In testimony whereof I affix my signature.

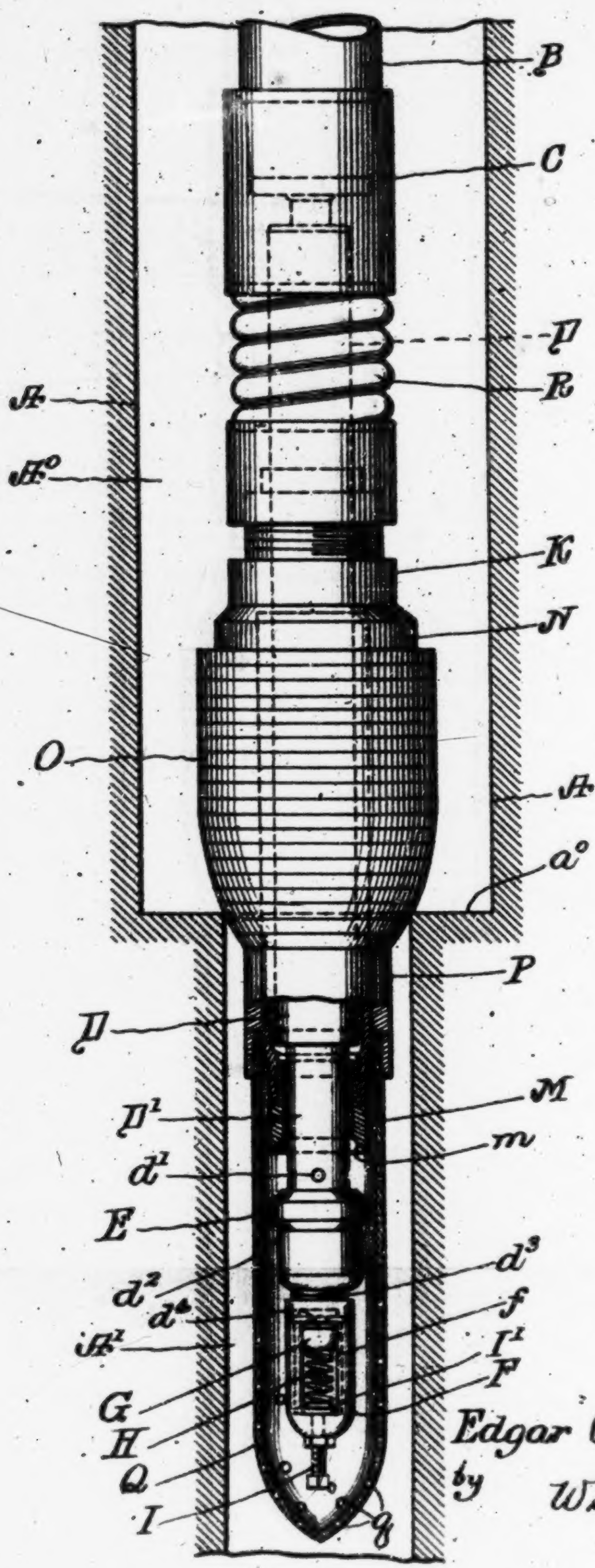
EDGAR CLINTON JOHNSTON.

an. 27, 1931. E. C. JOHNSTON 1,790,424 Jan

TOOL FOR TESTING WELL FORMATIONS

Filed Sept. 25, 1929 2 Sheets-Sheet 1

Fig. 1.



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TOOL FOR TESTING WELL FORMATIONS

Filed Sept. 25, 1929 2 Sheets-Sheet 2

Fig. 2.

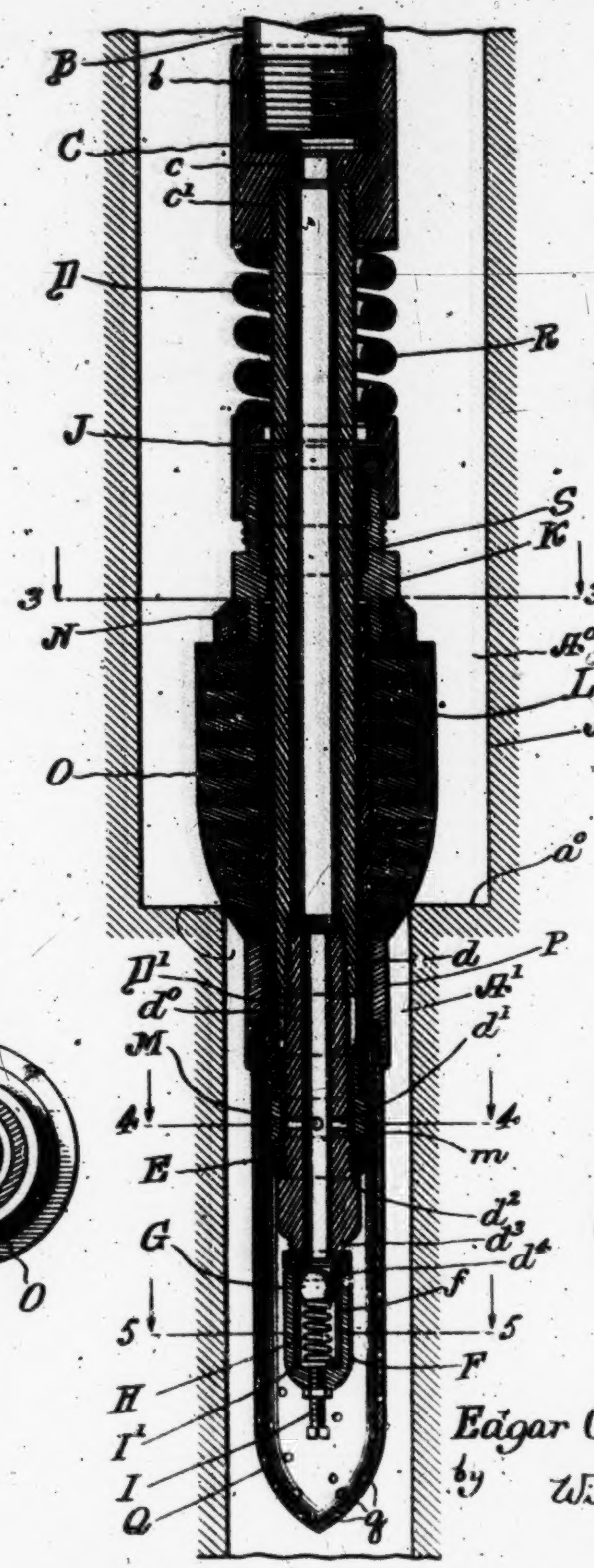


Fig. 4.

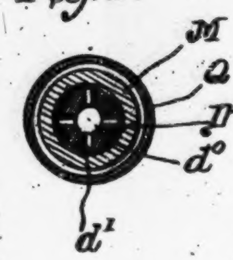


Fig. 3.

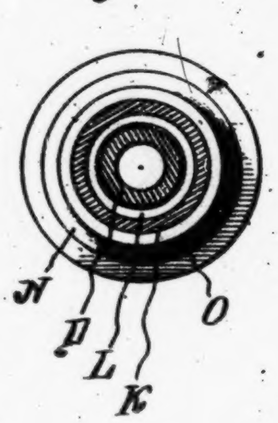
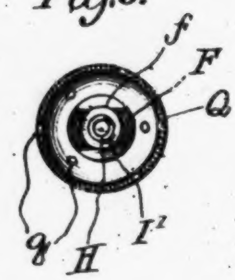


Fig. 5.



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Patented Jan. 27, 1931 1,790,424

UNITED STATES PATENT OFFICE

EDGAR C. JOHNSTON, OF EL DORADO, ARKANSAS

TOOL FOR TESTING WELL FORMATIONS

Application filed September 25, 1929. Serial No. 395,150.

My present invention relates to improvements in well testing tools, and it is especially intended to provide a well testing tool which may be used in connection with the drill pipe, the bit being removed, without the necessity of a double line of piping. The invention is intended to provide a compact and efficient testing tool which may be conveniently attached to or removed from the lower end of the drill pipe, and which may be conveniently used to test the various formations which may be encountered as the operation of boring the well progresses.

My invention is especially intended to provide certain improvements on the construction shown in my Patent No. 1,709,940, granted April 23, 1929, and entitled Well formation testing device.

My invention will be more fully understood after reference to the accompanying drawings, in which like parts are indicated by similar reference symbols throughout the several views, and in which,

Figure 1 shows a section through a well before the well casing has been inserted, and with the rat hole bored at the lower end thereof, with the testing tool shown therein in elevation and partly in section, and with the main valve in the open position,

Figure 2 is a similar view to Figure 1, but shows the apparatus in central vertical section with the main valve in closed position,

Figure 3 shows a section through the apparatus along the line 3—3 of Figure 2 and looking down,

Figure 4 shows a section along the line 4—4 of Figure 2, and looking down, and

Figure 5 shows a section along the line 5—5 of Figure 2, and looking down.

A represents the walls of the well bore A^0, and A′ represents the rat hole, and a^0 represents the bottom of the well bore, which constitutes a circular shelf surrounding the top of the rat hole A′. B represents the drill pipe which is threaded at its lower end b to engage the housing C, which is perforated, as at c, and is provided with internal screw threads c' to engage the tube D, which tube forms the upper portion of the valve stem D′ carrying the main valve E. The tube D and the valve stem D′ are screwed together, as at d, and the valve stem is vertically perforated, as at d^0, and is provided with lateral perforations d' for reasons that will be hereinafter described.

The lower end of the valve stem D′ is shouldered, as at d^2, and is screw threaded above said shoulder, so that the valve E may be screwed on and held in place on the stem. The lower end of the valve stem is screw threaded, as at d^3, to engage the cage F for the emergency valve G. This emergency valve is pressed on a seat d^4 at the end of the valve stem by the coil spring H, whose tension may be adjusted by the adjusting screw I and washer I′. The sides of this cage are open, as at f, see Figure 5, so as to permit the flow of liquid through the cage, as will be hereinafter more fully described.

Slidably mounted on the tube D and the valve stem D′ is an outer casing comprising the collar J, which is connected to the union K, which in turn is connected to the tube L.

To the lower end of this tube L, a tubular piece M is screwed, provided with the valve seat m. The parts L and M may be made integral, if desired, but for convenience in manufacture, it is preferable to have them separately connected together. The union K is externally threaded near its lower end to engage the collar N, which bears upon the upper end of the packer O. This packer is preferably made of a series of rings of rubber or leather or both, and is tapered toward the bottom so as to enter partly into the rat hole, as shown. Below the packer O, the tube L is externally screw threaded to engage the ring P to which the tubular valve casing Q is attached. This valve casing is in the form of a hollow shell with an ogival head, and encloses both the main valve E and the emergency valve G. This valve casing is perforated, as at q, to permit the passage of liquid, or partly liquid material, through the same and into the interior of the valve casing.

Above the collar J the coil spring R is mounted under compression, so as to hold the valve normally closed. Suitable packing S, see Figure 2, is provided between the tube D and the union K slidably mounted thereon.

The operation of the well testing tool is as follows:

Suppose the well to be bored in the usual way until a promising formation is reached, then draw up the drill pipe and remove the large bit, and put on a smaller bit and bore the rat hole to the desired depth.

The shoulder a^a of the rat hole will preferably be in a rock formation, so as to form a suitable seat for the packer, as will be hereinafter described.

After the rat hole has been bored, pull up the drill pipe and replace the bit with the testing tool, which may be done by simply screwing the housing C on to the lower end of the drill pipe, and then lower the drill pipe carrying the tool into the well. Ordinarily, no obstruction is had until the packer O brings up against the shelf a^a at the upper end of the rat hole. This will arrest the casing surrounding the valve stem, and the valve stem will continue for a brief instant, compressing the spring R and opening the valve, which will then assume the position shown in Figure 1. The main valve will be closed while the tube is being lowered into the well, as indicated in Figure 2. After the main valve is opened, some of the liquid in the formation reached by the valve casing will flow in through the perforations q, and passing around the valve will enter the valve stem D′, through the perforations d', and will flow up through the passage d^2 into the drill pipe.

It will be noted that the liquid flowing into these perforations d' will be well clear of both the valve and its seat, and will not tend to clog up the annular space between the valve and its seat when the main valve is open.

After the valve casing has been submerged in the liquid in the rat hole long enough to secure specimens, by lifting up on the drill pipe, until the packer is removed from its seat, the main spring D will automatically close the main valve and will also close the perforations d', and any liquid contained in the valve stem at the lower end of the drill pipe may be drawn up to the surface, and examined in the usual way.

Thus, it will be seen that the main valve automatically opens when the packer reaches the top of the rat hole, and is automatically closed when the packer is released from its engagement with its seat.

The foregoing operation assumes that the tool may be lowered through the open well, which ordinarily would not be provided with the well casing, until it reaches the rat hole, but should the tool encounter any obstacle as from the tumbling in of the side walls of the well before it reaches the rat hole, the drill tube and tool must be removed from the well and the obstruction removed. The removal of the tool will be materially facilitated by the insertion of liquid under pressure below the obstruction, and this may be accomplished from the surface of the ground by pumping liquid under pressure into the drill pipe, which will pass the apertures d', which will then be in a closed position, as shown in Figure 2, and this liquid will force the emergency valve G open against the spring H, and permit this liquid to flow out through the openings f in the cage F, and thence through the openings q of the valve casing Q into the well below the obstruction.

Thus by applying sufficient liquid pressure from beneath, the effort to lift the drill pipe carrying the tool up through the well will be greatly reduced; moreover, the liquid so introduced tends to lubricate the side walls of the well after the tool has been released from the obstruction, and this tool will facilitate the lifting of the drill pipe, especially where the side walls of the well have crumbled in.

It will be seen that any pressure from beneath in the well will tend to normally close the emergency valve and will also tend to force the main vave on its seat, whereas in the patented construction referred to, the pressure from beneath will tend to open the main valve.

It will be seen that the main valve and the emergency valve are close together, and are protected by the valve casing, which serves to screen off solid particles and permit the liquid or semi-liquid to enter from the well. Moreover, the parts may be readily assembled or disassembled for convenience of inspection or repair.

From the foregoing, it will be seen that the tool comprises (1) a hollow valve stem with means for attaching same to the drill pipe, said valve stem carrying the main valve and the emergency valve, (2) a casing slidably mounted on the valve stem carrying the packer, the valve seat, and the hollow casing for the two valves, and (3) a main spring mounted on the upper end of the hollow valve stem, tending to automatically hold the main valve on its seat.

While I have shown one embodiment of the invention in its preferred form, it will be obvious that various changes might be made in the construction, combination and arrangement of the parts, which could be used without departing from the spirit of my invention, and I do not mean to limit the invention to such details except as particularly pointed out in the claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States is:—

1. A testing tool for use incident to the drilling of oil wells, comprising a hollow valve stem, provided with lateral perforations, with means for securing said valve stem to the drill pipe, a main valve carried by said stem, a main frame slidably mounted on said valve stem, a sleeve provided with a

valve seat secured to said frame, said sleeve adapted to close said perforations, when the main valve is on its seat, a perforated hollow valve casing, attached to the lower end of said main frame and enclosing said main valve, a packer carried by said main frame, and a coil spring surrounding said valve stem and tending to press said frame and said valve stem in reverse directions, whereby said main valve is normally kept closed.

2. A testing tool for use incident to the drilling of oil wells, comprising a hollow valve stem, provided with lateral perforations, with means for securing said valve stem to the drill pipe, a main valve carried by said stem, a main frame slidably mounted on said valve stem, a sleeve provided with a valve seat secured to said frame, said sleeve adapted to close said perforations when the main valve is on its seat, a perforated hollow valve casing having an ogival point attached to the lower end of said main frame and enclosing said main valve, a packer carried by said main frame above said valve casing, and a coil spring surrounding said valve stem and tending to press said frame and said valve stem in reverse directions, whereby said main valve is normally kept closed.

3. A testing tool for use incident to the drilling of oil wells, comprising a hollow valve stem, provided with lateral perforations, with means for securing said valve stem to the drill pipe, a main valve carried by said stem, a cage carried by the lower end of said stem, a spring-impressed auxiliary valve mounted in said cage, and normally closing the lower end of said valve stem, a main frame slidably mounted on said valve stem, a sleeve provided with a valve seat secured to said frame, said sleeve adapted to close said perforations when the main valve is on its seat, a perforated hollow valve casing, attached to the lower end of said main frame and enclosing said main valve, and said cage, a packer carried by said main frame, and a coil spring surrounding said valve stem and tending to press said frame and said valve stem in reverse directions, whereby said main valve is normally kept closed.

4. A testing tool for use incident to the drilling of oil wells, comprising a hollow valve stem, provided with lateral perforations, with means for securing said valve stem to the drill pipe, a main valve carried by said stem, a cage carried by the lower end of said stem, a spring-impressed auxiliary valve mounted in said cage, and normally closing the lower end of said valve stem, a main frame slidably mounted on said valve stem, a sleeve provided with a valve seat secured to said frame, said sleeve adapted to close said perforations when the main valve is on its seat, a perforated hollow valve casing having a tapered point attached to the lower end of said main frame and enclosing said main valve and said cage, a packer carried by said main frame above said valve casing, and a coil spring surrounding said valve stem and tending to press said frame and said valve stem in reverse directions, whereby said main valve is normally kept closed.

5. A testing tool for use incident to the drilling of oil wells, comprising a hollow valve stem, provided with lateral perforations, with means for securing said valve stem to the drill pipe, a main valve carried by said stem, a main frame slidably mounted on said valve stem, a valve seat secured to said frame, a perforated hollow valve casing attached to the lower end of said main frame and enclosing said main valve, a packer carried by said main frame, and a coil spring surrounding said valve stem and tending to press said frame and said valve stem in reverse directions, whereby said main valve is normally kept closed.

6. A testing tool for use incident to the drilling of oil wells, comprising a hollow valve stem, provided with lateral perforations, with means for securing said valve stem to the drill pipe, a main valve carried by said stem, a main frame slidably mounted on said valve stem, a valve seat secured to said frame, a perforated hollow valve casing having an ogival point attached to the lower end of said main frame and enclosing said main valve, a packer carried by said main frame above said valve casing, and a coil spring surrounding said valve stem and tending to press said frame and said valve stem in reverse directions, whereby said main valve is normally kept closed.

7. A testing tool for use incident to the drilling of oil wells, comprising a hollow valve stem, provided with lateral perforations, with means for securing said valve stem to the drill pipe, a main valve carried by said stem, a cage carried by the lower end of said stem, a spring-impressed auxiliary valve mounted in said cage, and normally closing the lower end of said valve stem, a main frame slidably mounted on said valve stem, a perforated hollow valve casing attached to the lower end of said main frame and enclosing said main valve, and said cage, a packer carried by said main frame, and a coil spring surrounding said valve stem and tending to press said frame and said valve stem in reverse directions, whereby said main valve is normally kept closed.

8. A testing tool for use incident to the drilling of oil wells, comprising a hollow valve stem, provided with lateral perforations, with means for securing said valve stem to the drill pipe, a main valve carried by said stem, a cage carried by the lower end of said stem, a spring-impressed auxiliary valve mounted in said cage, and normally closing the lower end of said valve stem, a main frame slidably mounted on said valve

stem, a valve seat secured to said frame, a perforated hollow valve casing having a tapered point attached to the lower end of said main frame and enclosing said main valve and said cage, a packer carried by said main frame above said valve casing, and a coil spring surrounding said valve stem and tending to press said frame and said valve stem in reverse directions, whereby said main valve is normally kept closed.

9. A testing tool for use incident to the drilling of oil wells, comprising a hollow valve stem, provided with lateral perforations, with means for securing said valve stem to the drill pipe, a main valve carried by said stem, a cage carried by the lower end of said stem, a ball valve mounted in said cage, a coil spring also mounted in said cage, and normally holding said ball against the lower end of said valve stem, a main frame slidably mounted on said valve stem, a valve seat secured to said frame, a perforated hollow valve casing attached to the lower end of said main frame and enclosing said main valve, and said cage, a packer carried by said main frame, and a coil spring surrounding said valve stem and tending to press said frame and said valve stem in reverse directions, whereby said main valve is normally kept closed.

10. A testing tool for use incident to the drilling of oil wells, comprising a hollow valve stem, provided with lateral perforations, with means for securing said valve stem to the drill pipe, a main valve carried by said stem, a cage carried by the lower end of said stem, a ball valve mounted in said cage, a coil spring also mounted in said cage, and normally holding said ball against the lower end of said valve stem, means for adjusting the compression of said coil spring, a main frame slidably mounted on said valve stem, a valve seat secured to said frame, a perforated hollow valve casing attached to the lower end of said main frame and enclosing said main valve, and said cage, a packer carried by said main frame, and a coil spring surrounding said valve stem and tending to press said frame and said valve stem in reverse directions, whereby said main valve is normally kept closed.

11. A testing tool for use incident to the drilling of oil wells, comprising a hollow valve stem, provided with lateral perforations, with means for securing said valve stem to the drill pipe, a main valve carried by said stem, a cage carried by the lower end of said stem, an auxiliary valve and a valve spring under compression also mounted in said cage, said auxiliary valve normally closing the lower end of said valve stem, means for adjusting the compression of said spring, a main frame slidably mounted on said valve stem, a sleeve provided with a valve seat secured to said frame, said sleeve adapted to close said perforations when the main valve is on its seat, a perforated hollow valve casing attached to the lower end of said main frame and enclosing said main valve and said cage, a packer carried by said main frame above said valve casing, and a coil spring surrounding said valve stem and tending to press said frame and said valve stem in reverse directions, whereby said main valve is normally kept closed.

EDGAR CLINTON JOHNSTON.

June 4, 1929 J. L. JOHNSTON ET AL 1,715,504

RELEASABLE VALVE

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Fig 3

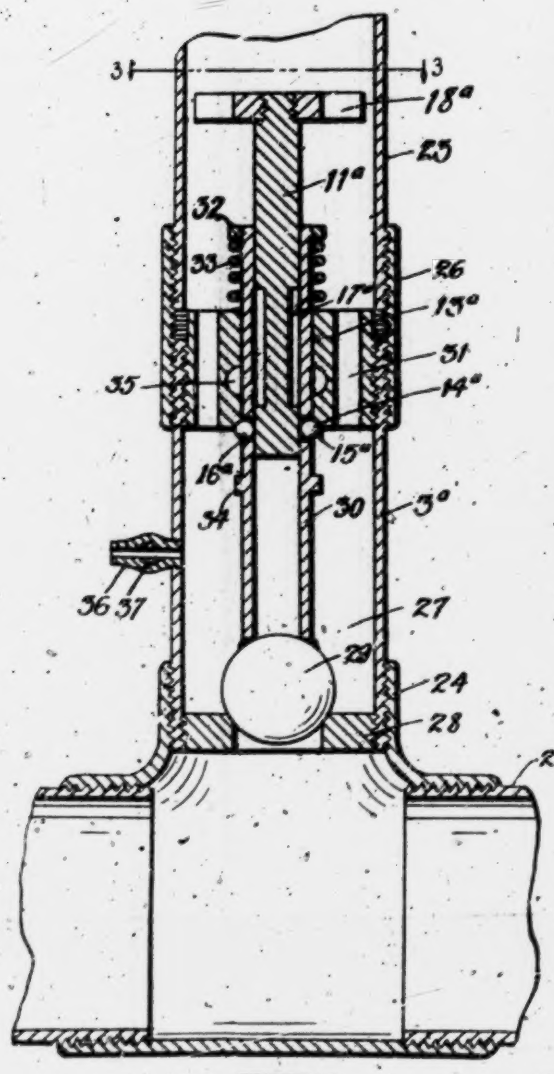

Fig 2

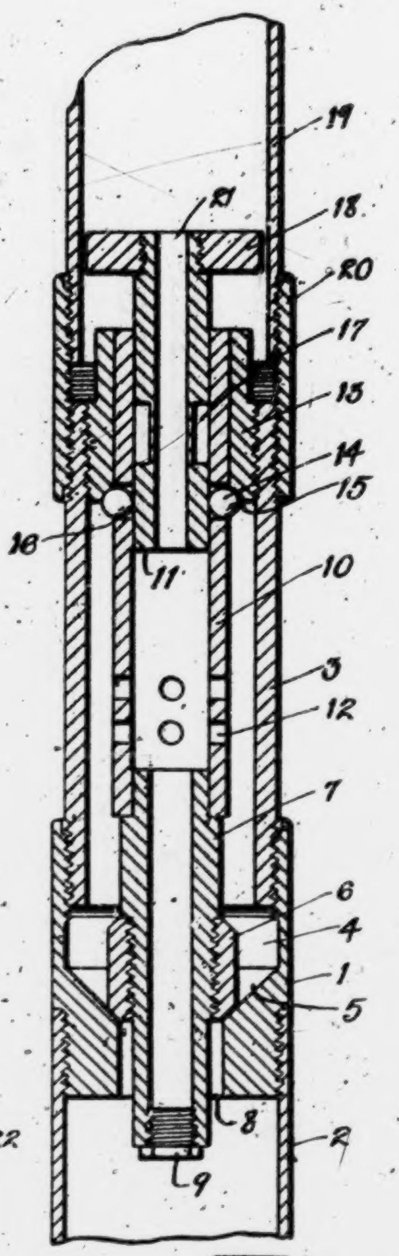

Fig 1

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June 4, 1929. J. L. JOHNSTON ET AL 1,715,504

RELEASABLE VALVE

Filed Aug. 10, 1928 2 Sheets-Sheet 2

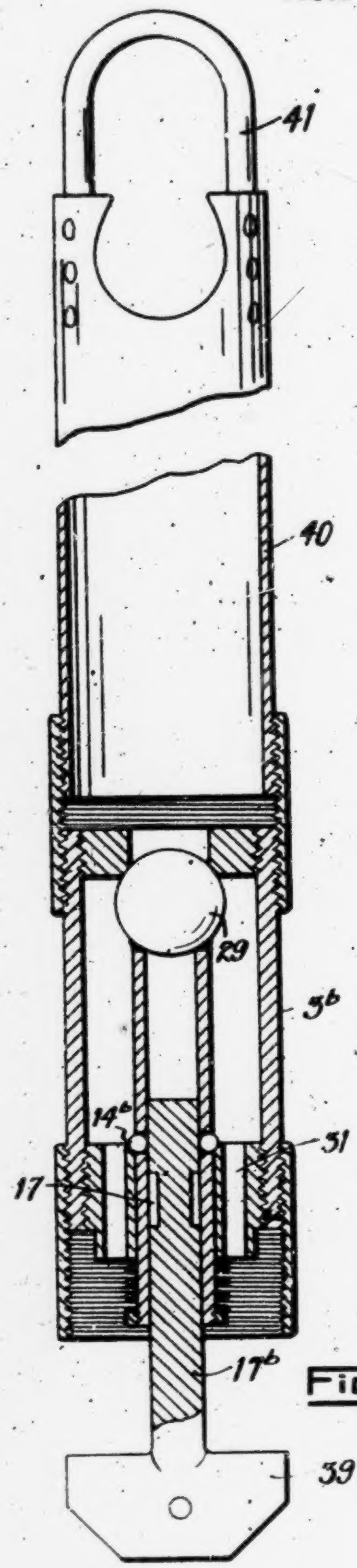

Fig 5

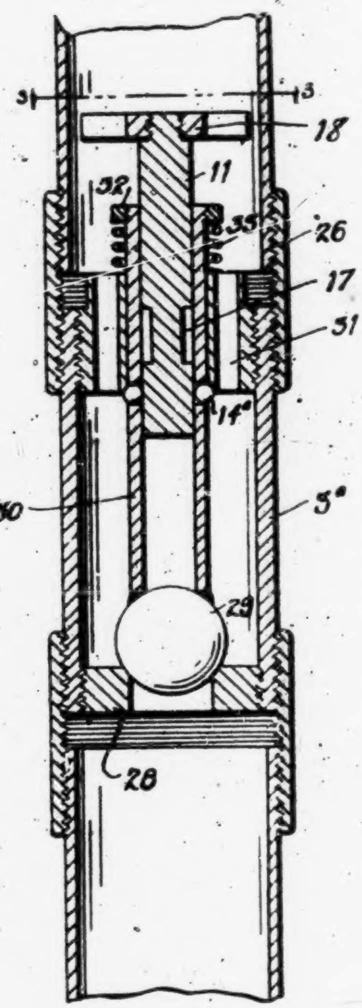

Fig 4

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UNITED STATES PATENT OFFICE.

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RELEASABLE VALVE.

Application filed August 10, 1928. Serial No. 298,818.

Our invention relates to valves generally, but more particularly to valves which may be employed for oil field work, said valves being of the type which are normally closed, but which may be released and opened while in inaccessible positions without removing the same from its position, or exposing the valve for manipulation.

It frequently happens, in oil field operations, that it is desirable to employ a valve in pipes such as drill stems, eduction pipes for conducting oil from a well, pipe line laterals, dump buckets for cement, and the like; where the valve is closed when introduced into the well, or otherwise positioned for use, but which must be capable of opening thereafter at the proper time.

It is an object of our invention to provide a valve of simple construction, which may be released from locked position after it has been introduced into the well, or after it has been placed in an inaccessible position in a pipe line.

It is desired that means be provided upon the valve to latch it firmly in closed position, but which may be positively released by means introduced into the pipe and operated through gravity or by fluid pressure, or other similar means, when the opening of the valve is desired.

It is also an object to employ means which, when the valve has been released, will automatically latch the valve in open position.

It is to be understood that the valve is capable of wide application but, in the drawings we have shown several embodiments thereof, illustrative of certain of the devices in which it may be employed.

Fig. 1 is a central vertical section of a valve in a fluid line adapted for well work.

Fig. 2 shows a broken section of pipe line, with our valve shown in a lateral line connected therewith, the device being in central horizontal section.

Fig. 3 is a transverse section on the plane 3—3 of Fig. 2. Fig. 4 is a central longitudinal section through a valve embodying our invention, this form being similar to the Fig. 2 embodiment. Fig. 5 is a longitudinal section through a dump bucket employing the invention shown in Fig. 4.

In Fig. 1 an embodiment of the invention is shown which may be employed in a casing or other pipe when said pipe is introduced into the well; as for example, when a casing is floated into the well to take the weight off the line. It is, however, adapted for various similar uses. In this structure there is a lower valve casing 1 threaded at its lower end to connect with a pipe or shoe 2, projecting in advance of the valve. The upper end of the casing is threaded internally to connect with a barrel or housing 3. On the inner part of the casing 1 is a chamber 4, below which the walls of the casing are thickened and provided with a downwardly tapered seat 5, to receive the valve 6. Below the valve seat the passage 7 leads through to the pipe 2.

The valve 6 is formed by a collar or ring screwed upon a tubular stem 7. The valve is tapered at both ends to fit the seat, and may be unscrewed from the stem and reversed to accommodate for wear. The lower end of the stem 8 is threaded to receive a plug 9, closing the same.

The upper end of the stem 7 is secured to a cylinder 10, which forms an extension thereon; the interior of the cylinder being formed to receive a releasing plunger 11.

The said cylinder is provided with a series of openings 12 above the stem 7, and its upper end is extended to fit within a stop collar 13. The said collar is screwed within the upper end of the barrel 3, and the lower end thereof is formed with an inclined shoulder 14 which acts as a stop for the latching balls 15.

The balls 15 are set in openings 16 in the cylinder 10 at a level spaced from the upper end of the cylinder. They are held in position, projecting through these openings against the shoulder 14 by the plunger 11. Said plunger fits closely within the cylinder, and has a frictional fit therein. It is adapted to slide in the cylinder, however, when force is applied to the upper end thereof. Intermediate the ends of the plunger is an annular groove 17, said groove being adapted to receive the balls 15 and, as will be noted, the groove is materially wider than the balls. The upper end of the plunger has a top plate or disc 18 which may be screwed on the reduced upper end of the plunger.

The barrel 3 is connected to the main line of the casing 19 by means of a coupling 20.

When this device is employed as a valve for floating casing into the well, it is assembled as shown in Fig. 1. The balls 15 are placed in proper position and the hold-down

collar 13 is adjusted into position to hold the valve 6 firmly in its seat. In this position it is introduced into the well and will serve to prevent fluid from entering the lower end of the pipe. When it is desired to release this valve to allow fluid to enter the casing a heavy object such as a pipe coupling or a heavy ball valve may be dropped from the surface downwardly through the casing 19, striking a blow upon the plunger plate 18. This will drive the plunger downwardly in the cylinder 10 bringing the groove 17 in the plunger opposite the balls 14, allowing the balls to move from their position against the shoulder 14 and thereby releasing the cylinder 10 and the valve so that the fluid pressure from below the valve may raise it from its seat. The fluid from below will then pass into the valve chamber 4 and upwardly through the openings 12 to the interior of the cylinder 10. It may then flow upwardly through a central passage 21 in the plunger to the interior of the casing.

It will be obvious that this valve may be used in this manner for other purposes than in floating casing into the well. This use of the device is given as illustrative only of one way in which it may be employed.

It may be changed slightly for use in pipe line work, and, in Figs. 2 and 3, we have shown how it may be thus used. In pipe lines, lateral connections leading to the main line are sometimes not used for a material length of time and must be closed by a valve adjacent the connection between the lateral line and the main line. It is desirable to employ a valve which is not open for manipulation from the outside, but which may be opened when the lateral is brought into use. Our valve may be employed for this purpose. In Fig. 2, the main line is indicated at 22. The lateral line 23 is connected thereto by means of a T-shaped coupling 24. A short section of pipe 3ᵃ is employed as a casing connecting the lateral line 23 with the coupling, said line and casing being connected through the collar 26.

Within the casing 3ᵃ is a valve chamber 27, a valve seat is formed at the inner end of the casing by means of a plate 28, having an opening therein to receive a ball valve 29.

The ball valve 29 is secured, by welding or otherwise, to the inner end of a tubular valve stem 30. Said stem is slidable within the stop collar 13ᵃ, similar in construction to the stop collar of the previous embodiment except that it has longitudinal openings 31 therethrough, connecting the valve chamber with the line 23.

The stem 30 forms a cylinder to receive the plunger 11ᵃ which is slidable therein and has a circumferential groove 17ᵃ into which the latching balls 15ᵃ may be received. Said balls are fitted within openings 16ᵃ and bear against a shoulder 14ᵃ which holds the valve stem and valve in closed position. The upper end of the stem 30 has a nut 32 thereon and a spring 33 bearing against said nut and the upper end of the stop collar 13ᵃ tends to force the valve stem and valve away from the valve seat. The stem is formed with a radial flange 34, spaced from the inner side of the stop collar, to limit the movement of the stem outwardly. On the inner side of the stop collar 13ᵃ we may provide an annular groove 35 to receive the latching balls 15ᵃ. The outer end of the plunger has thereon a plate 18ᵃ as in the previous embodiment. From Fig. 3 it will be noted that this plate has radial arms which allow the free passage of fluid between them.

A lateral vent 36 may be formed in the casing 25, said vent having a cock 37, whereby the flow of fluid therethrough may be controlled.

In the operations of this device, the valve will be normally closed. When it is desired to pump fluid through the pipe 23 to the main line, a loose fitting plunger or similar device may be placed in the line 23 ahead of the oil. The tap 37 will be opened to allow a vent for air ahead of the plunger. The plunger will be forced by the oil being pumped into the line, against the plate 18ᵃ, moving the plunger 11ᵃ inwardly until the groove 17ᵃ receives the latching balls. The spring 33 will then throw the valve 29 into open position and the fluid will pass through the openings 31 to the pipe line. The tap 37 may then be closed.

The arrangement of the groove 35 in the stop sleeve 13ᵃ will enable us to latch the valve in open position, the balls 15ᵃ will enter the groove 35 by gravity and will prevent the sliding of the stem thereafter.

In Fig. 4, the Fig. 2 embodiment is shown as adapted for use in the same manner as is that shown in Fig. 1, for floating a pipe into the hole, or for similar operations. The means for latching the valve in open position is, however, omitted, it being understood that this feature of the valve may be employed wherever desirable.

In Fig. 5, the valve is adapted for use on a dump bucket such as is employed in handling cement in completing the setting of casing. Here the valve is inverted in position. The ball 29 is below the seat and the plunger 11ᵇ is formed with a dart 39 on the outer end as is usual with dump valves. The valve 3ᵇ is connected at its upper end to the bucket 40 having a bail 41.

When the device is operated, the bucket is assembled as seen in Fig. 5 with the valve closed. The bucket is filled with cement and lowered in the usual way to the bottom of the well. When the bottom is reached, the dart 39 will strike the bottom and the plunger will be moved to bring the groove 17 into registration with the latching balls allowing them to move free of the shoulder 14ᵇ

so that the spring 33 will open the valve 29 allowing the cement to be dumped and the bucket withdrawn.

It will be readily understood from the examples above noted that the valve structure illustrated is adapted for various uses where the valve is inaccessible for manual control when the opening becomes desirable.

What we claim as new is:

1. A valve including a casing, a valve seat therein, a valve in said seat, a valve stem on said valve, a stop sleeve through which said stem is slidable, balls in said stem adapted to contact with said sleeve, means to release said balls and means to open said valve when said balls are released.

2. A valve including a casing, a valve seat therein, a valve member in said seat, a valve stem on said member, a stop collar through which said stem is slidable, a shoulder on the side of said stop collar adjacent said valve member, balls in said stem adapted to engage said shoulder when said valve is closed, means to hold said balls in latching position, but adapted to be moved to release said balls and said valve member.

3. A valve including a casing, a valve seat therein, a valve member in said seat, a valve stem on said member, a stop collar through which said stem is slidable, a shoulder on the side of said stop collar adjacent said valve member, means on said stem engaging said shoulder to hold said valve member in closed position, and means slidable relative to said stem to release said holding means, to allow said valve to be opened.

4. A valve including a casing, a valve seat therein, a valve member in said seat, a valve stem on said member, a stop collar through which said stem is slidable, a shoulder on the side of said stop collar adjacent said valve member, means on said stem engaging said shoulder to hold said valve member in closed position, a cylinder in said stem, a plunger in said cylinder engaging said holding means, said plunger being adapted to move responsive to a blow thereon and release said holding means.

5. A valve including a seat, a valve member in said seat, a stem on said valve member, a stop collar having a shoulder adjacent said stem, means on said stem engaging said shoulder to hold said valve member in said seat, and means slidable in said stem to release said holding means.

6. In a valve, a casing, a valve seat therein, a valve member in said seat, a valve stem on said valve, a cylinder on said stem, a plunger in said cylinder, a shoulder in said casing, means on said cylinder engaging said shoulder to hold said valve member in said seat, said means being releasable by the inward movement of said plunger.

7. In a valve, a casing, a valve seat therein, a valve member in said seat, a valve stem on said valve, a cylinder on said stem, a plunger in said cylinder, a shoulder in said casing, balls in the walls of said cylinder engaging said shoulder to hold said valve closed, means holding said balls in position engaging said shoulder, said means being slidable relative to said stem to release said balls.

8. In a valve, a casing, a valve seat therein, a valve member in said seat, a valve stem on said valve, a cylinder on said stem, a plunger in said cylinder, a shoulder in said casing, means on said cylinder engaging said shoulder to hold said valve member in said seat, said means being releasable by the inward movement of said plunger and positive means to throw said valve member into open position when said stem is released.

9. In a valve, a valve casing, a valve seat therein, a stop collar, a valve member in said seat, a valve stem slidable in said collar, means on said stem engaging said collar to hold said valve member in said seat and means responsive to pressure thereon to release said holding means.

10. In a valve, a valve casing, a valve seat therein, a stop collar, a valve member in said seat, a valve stem slidable in said collar, means on said stem engaging said collar to hold said valve member in said seat, means responsive to pressure thereon to release said holding means and means to force said valve from its seat.

11. In a valve, a valve casing, a valve seat therein, a stop collar, a valve member in said seat, a valve stem slidable in said collar, means on said stem engaging said collar to hold said valve member in said seat, means responsive to pressure thereon to release said holding means, means tending to move said valve member from its seat, and means whereby said holding means may latch said valve member in open position.

12. A valve including a casing, a seat at one end thereof, a valve member in said seat, a stem on said valve, and adjustable stop collar in which said stem is slidable, a cylinder in said stem, balls fitting in openings in the wall of said cylinder, a plunger in said cylinder adapted to force said balls into position to engage said collar and hold said valve in said seat, said plunger having recesses to receive said balls, when said plunger is moved into said cylinder and thus release said valve member.

13. A valve including a casing, a seat at one end thereof, a valve member in said seat, a stem on said valve, an adjustable stop collar in which said stem is slidable, a cylinder in said stem, balls fitting in openings in the walls of said cylinder, a plunger in said cylinder adapted to force said balls into position to engage said collar and hold said valve in said seat, said plunger having recesses to receive said balls, when said plunger is moved into said cylinder and thus release said valve

member, and a spring tending to move said valve stem and valve member when said stem is released.

14. A valve releasing mechanism including in combination a plunger, a concentric sleeve surrounding said plunger, a plurality of apertures in said sleeve and movable means in said apertures, a stop collar about said sleeve, said means adapted to contact with said plunger and said collar to hold the sleeve in rigid engagement therewith.

15. A valve releasing mechanism including in combination a plunger, a concentric sleeve surrounding said plunger, a stop collar about said sleeve, and means carried by said sleeve and operable by said plunger whereby the collar is engaged or disengaged.

16. A valve stem comprising in combination a plunger, an annular cavity on said plunger, a stem, movable means carried by said stem and adapted to partially enter said cavity and a stop collar surrounding said stem to force the movable means into said cavity upon movement of said plunger.

17. A valve releasing mechanism including in combination a plunger, a concentric sleeve surrounding said plunger, a stop collar about said sleeve and means movable through said sleeve to engage or disengage said collar.

In testimony whereof we hereunto affix our signatures this 1st day of August, A. D., 1928.

JAMES L. JOHNSTON.
EDGAR C. JOHNSTON.
BLAINE JOHNSTON.